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E. H. Embley Memorial Lecture.¹

(The University of Melbourne.)

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FROM time immemorial there has always been a very natural custom of commemorating the passing of the great. Emperors and kings, great soldiers and sailors, explorers, statesmen, in fact men and women of outstanding merit in any sphere of life are those thus honoured.

There has always been a veneration for the dead, usually owing to the narrow perspective of family affection and intimate knowledge of the life that has passed, but this veneration does not persist in this

mundane world for any length of time in the absence of outstanding greatness or achievement attached to those lives keeping their memory fresh. Millions of statues and tombstones are scattered about the world to the memory of lives that have gone and are forgotten: lives which seemed worthy of the expenditure of large sums of money by friends and relatives in pathetic attempts to prove their dead worthy of a niche in the temple of fame. The statue tends to lose its original significance, and its merit in after ages tends to be based upon its artistic value rather than upon the memory of the individual it is supposed to commemorate. Lumps of marble and bronze are static: scholarship and progress are dynamic.

The relief of pain is one of the greatest boons to mankind—such is anaesthesia; and when a pioneer in this subject died it was this natural desire of his fellows to commemorate his work in some lasting manner. Such a pioneer was Edward Henry Embley, whose memory we are here to honour. We have to

¹ Delivered September, 1935.

consider how the seed he sowed, which had only become a small plant when he died, has grown in the last eleven years.

The death of such a man causes an immediate shock which seems irreparable at the time, but Nature is kind, and in the passage of years it is possible to look back with an unprejudiced mind and to form a balanced estimate of the value of the work he has done.

It was the wish of Embley's colleagues and friends to perpetuate his memory; hence the endowment of this lecture and a medal to be given annually to the best student of the year for an essay on the subject which was so near his heart—anaesthesia. In doing this Mr. Mitchell, his son-in-law, and many other subscribers to the fund acted as Embley and indeed any medical man would wish, and they chose the practical and most certain method of keeping his memory alive and of maintaining a permanent interest in the subject of anaesthesia. The gold medal will always cause keen competition among the students of this great university, and in your appointment of a lecturer you have the opportunity of honouring a senior man who has spent a great part of his life in the study of this branch of our work.

May I express here my appreciation of the honour you have done me in choosing me to deliver this lecture, and my sensibility of the duty imposed upon me of bringing the subject up to date.

As Professor Osborne so truly explained in the opening words of the first Embley Memorial Lecture in 1932, it is customary for the first lecture of a series to be biographical, and I am sure that those of you who heard, or have since read, that lecture will agree that no one could have done it more ably. It was written from the standpoint of a man who was Embley's close personal friend and for whose scientific and practical work he had a great admiration. With the passage of time it can be given to few of the lecturers of the future to have this advantage, and indeed in a short time there will naturally be fewer and fewer men to be found who knew Embley personally. It was my privilege to meet him in London in 1913 at the International Congress of Surgery, just before the Great War. I heard him read his paper at that congress on the "Dosimetry of Chloroform", and followed him at the same meeting with a paper of my own on the earliest of the barbiturates, hedonal, and its use in cerebral surgery. Embley did me the honour of coming to the National Hospital, Queen Square, to see how this drug was given. There he saw the late Sir Percy Sargent remove a lateral recess tumour under hedonal infusion anaesthesia. I remember the incident well, as the late Sir Victor Horsley came into the theatre and, as he was very critical of this form of anaesthesia, he would not have it used for his own cases. I am going to explain later that Horsley was an out-and-out advocate for chloroform, and hence was a man after Embley's own heart, and they had a long discussion which was brought about by the modified form of the Vernon Harcourt inhaler in use at the hospital at that time. This inhaler, as some of you may remember, was a dosimetric method for the use of chloroform. That meeting early one

morning in 1913, twenty-two years ago, is clearly defined in my memory. Horsley and Embley talked of chloroform in a way with which I could not then agree, but with which I am much more in sympathy now.

Alas, of those four I alone remain: Horsley, Embley, Sargent have all gone, and writing of them has made me wonder what they would have thought of the form of anaesthesia which, owing to the changed technique in surgery, I now practise in that same theatre—two of the greatest brain surgeons who have ever lived, who knew what they wanted and got it—a short light anaesthesia—and an anaesthetist, Embley, who was all in sympathy. What would these men have thought of the modern operation necessitating a perfectly quiet anaesthesia for any length of time up to eight or nine hours? This time factor is a remarkable innovation: I should like to have been able to say that a great advance has taken place, but I cannot make myself believe it, and already I see signs of these operations being speeded up and hear reports from other countries of the same tendency.

In no department of surgery has a change been more marked since Embley's time than in cerebral surgery. All my working life I have been closely associated with Sir Charles Ballance, Sir Victor Horsley, Sir Percy Sargent, Donald Armour, the present staff of the National Hospital, and others, so I feel confident to speak with authority on this matter.

The modern cerebral operation takes some surgeons anything from four to nine hours. The fact that I have given anaesthetics for six successful cerebral operations in a day, none of which took more than an hour, makes me wonder if the prolonged operations are essential. Further than this, it became my duty during the War to operate on cerebral cases at Saint Thomas's Hospital.

The fact that I cannot understand why it is necessary to be so slow, for example in removing a bone flap (two hours or more) and again two hours in sewing up a scalp, does not concern this argument. It is my business to provide an efficient anaesthesia, and that necessitates new methods. I may here say that the modern prolongation of surgical processes does not apply only to brain surgery. It applies also to general surgery; for example, three hours for an uncomplicated gastrectomy, two hours for enucleation of tonsils, two hours for a prostatectomy. To return to brain surgery, where all the difficulties and dangers of anaesthesia are accentuated. For instance, it is difficult to estimate the condition of a patient who is pulseless from traction on the medulla or who from high intracranial pressure refuses to breathe. These are both common occurrences in cases I am expected to deal with. Compare all this with the light chloroform anaesthesia demanded by Horsley, which, owing to his marvellous ambidexterity and speed, was all that was necessary—three Gasserian ganglia removed one after the other in an hour and three quarters, and the patients conscious before leaving the theatre. Then came Sargent with division of the sensory root only. This meant quiet anaesthesia for an hour; and as it happened he

disliked the very smell of chloroform; he preferred ether preceded by atropine. The ambidexterity of Horsley and the wonderful dexterity of Sargent are not given to every man: their speed was wonderful; they had no reason to spend eight or nine hours on one case. Surgical technique and asepsis prevent the anaesthetist obtaining access to the head, so other methods of anaesthesia than by the oral route had to be tried. Ether given *per rectum* and intravenously, which had the objection of boiling off at body temperature, paraldehyde given *per rectum* and intravenously, alcohol given intravenously—all were tested; each had objections.

In 1912 came the first of the long series of the barbiturates, hedonal, given intravenously. After meeting Embley at the Congress in London in 1913, and after my paper giving the results of eighty-five brain tumours removed by this means, the War came and hedonal was unobtainable. My supply was soon exhausted, and we had other things to think about. I was doing heavy surgical operating work myself, so I took up ether again and used it by the intratracheal route with a Kelly's machine. Many a time during the War I passed the intratracheal catheter first then cleaned up and did the operation. This anaesthesia was so successful that it remained my routine for over fifteen years after the War and long after my surgical efforts were over. Sargent would have nothing else used for his cases. Then some surgeons became infected by the slow motion bacillus, and ether under pressure for long periods was useless. An expiratory valve was placed on the feed, a larger catheter was used, and finally gas and oxygen as the vehicle for ether instead of air from a blower, which makes a quiet anaesthesia possible with smaller quantities of ether. Such still remains my routine in cerebral surgery, and up to date I know of nothing better.

How Embley would have dealt with such a change can only be problematical, but in studying his published work, over which I have spent many hours, there is no doubt in my mind that he would have had much to say with the authority of many years' practical experience and with his great physiological knowledge behind him. Judging from the mass of his scientific papers, he was primarily a physiologist by inclination and an anaesthetist by necessity. I do not think that the writer of the very critical, almost peevish letter to the *Intercolonial Medical Journal* in 1908, which elicited an editorial note, would not have expressed his views fearlessly. This letter was due to some remarks by a coroner who had not credited Embley with some of his published work, and, reading between the lines of the letter, there is no doubt that he had the same distrust of the value of the coroner's opinion as to the cause of a death under an anaesthetic as many of us have now. It is generally agreed that as scientific records the results of coroner's inquests are useless, and are not only incorrect, but are also harmful.

Turning more particularly to his scientific investigation, Embley, working with Martin, on the basis of their work upon the circulation in the kidneys, pointed out that vaso-constriction is produced by a high percentage of chloroform in the blood. If, however, this percentage is kept down to a level

which can be produced by inhalation, vaso-dilatation occurs. This causes the congestion of the venous system and the fall in blood pressure, facts that are universally admitted. This brought Embley into a controversy over the findings of the Hyderabad Commission. The chief conclusion of the Commission was that death under chloroform was due to a failure of the respiratory system. They denied that a primary cardiac failure occurred, and relied upon tracings which physiologists now say show a gradual weakening of the heart muscle. Embley was one of those who did experimental work to prove this. Such experiments as I saw at Chicago in 1923 leave no doubt in my mind whatever that chloroform has a direct action on the heart muscle in dogs when the air-way is rendered perfect by means of a tracheotomy tube. My practical experience for over thirty years confirms this view.

In 1911 Embley, in a presidential address in the Section of Anatomy, Physiology and Pharmacology, wrote a very able paper on syncope, collapse and shock. I can hardly believe he ever gave it as an address; it is too long and too involved. However, it is the best paper I have ever read on the subject, full of original work, and should be read by every anaesthetist. It stamps the writer as a thinker, a scientist, and a practical anaesthetist, and although these observations were made by Embley in 1911, many of them might well be quoted in the "Manual of Anaesthetics" published by the Melbourne Baker Institute of Medical Research, in the next edition of their monograph. He had the temerity to disagree with Crile's statement that gas and oxygen affords the most effective blockage of afferent nerve impulses reaching the central mechanism, and stated that gas and oxygen and ether were more efficient. This statement is in agreement with the modern trend of opinion, but it needed a bold man to express this view in 1911.

In that paper, too, when dealing with shock, he points out the futility of using strychnine, especially during anaesthesia, a practice which we must all have seen resorted to, though many of us have been teaching its uselessness. Ergot, pituitary extract, and adrenaline come in for the same criticism. When it was a common practice to use isotonic salt solution he was very downright about its abuse, as the fluid rapidly passes into the tissues, causing general or pulmonary oedema. The whole paper was years ahead of its time.

In *The British Medical Journal* as early as 1902 Embley published three articles with numerous tracings on "The Causation of Death During the Administration of Chloroform". He starts off by quoting records he had collected of a hundred and twenty-four deaths under chloroform, a hundred and seven of which occurred before the operation had begun. He then gives a most complete history of all the experimental work which had been done on chloroform up to that date. Following this he gives his own experiments on two hundred and eighty-nine dogs. Some of his findings are, or should be, classical. He says:

Chloroform has an immediate and progressive effect on the heart muscle. There is no preliminary period of stimulation. There is no abrupt change in the rate of efficiency of the heart.

In the second article again :

Chloroform raises the excitability of the vagus mechanism particularly in the early part of the administration. Dangerous inhibition is liable to occur whenever the strength of the chloroform vapour in the air inhaled rises above two per cent.

Then again :

The cause of the fall of blood-pressure from administration of chloroform is paralysis of the muscle cells of the heart and of the arterioles. The fall may be further augmented by the slowing of the heart's rate, or suddenly brought to zero by vagus inhibition of the heart.

Atropinization of dogs absolutely abolishes sudden heart arrest from chloroform.

Failure of respiration in inhalation experiments is mainly due to fall in blood pressure. With good blood pressure failure of respiration by inhalation of chloroform is practically impossible.

From all this scientific work comes the clinical aphorism : "Give atropine and take time in putting the patient under."

These articles produced a laudatory leader in *The British Medical Journal*, April 12, 1902, showing how three years' work in the laboratory could produce immediate results in clinical work in saving life, and again emphasizing the importance of using a low percentage vapour for inhalation and the routine use of atropine. They also brought two letters from Colonel Lawrie, who naturally supported the dictum of the Hyderabad Commission : "Safety in plenty of air and plenty of chloroform." Another article contained an interesting statement about the routine anaesthesia used in France by Dastre and Morat, who always gave a preliminary dose of morphine and atropine, and who claimed "many thousands" of cases without fatality, which was in contrast to their previous experience. I only vaguely remember the storm which was going on at this time, but, looking back, one realizes that much of the chloroform mortality was due to pushing the anaesthetic too quickly, causing a holding up of respiration, a high concentration of vapour forming under the mask, then a long deep inspiration and consequent inhalation of an overdose.

The later deaths were due to attempts to get relaxation for prolonged periods to enable the surgeons to perform the much more complicated and prolonged operations which were introduced even in those days.

Embley, discussing ether anaesthesia, pointed out that the respirations are at first hurried and deep, subsequently they become slower and more shallow, and eventually, if ether is pushed to a dangerous extent, cease altogether. Provided the respiratory acceleration is only moderate, it assists circulation, and so raises the blood pressure; if excessive, it has the opposite effect, and by increased lung ventilation lowers the tension of carbon dioxide, producing an acapnic condition. Failure of respiration is rapidly followed by cessation of the heart beat. These effects are also produced by exhaustion following over-stimulation, and should be kept constantly in mind when an inhalation is likely to be greatly prolonged. The slowing and final cessation of the respiration appear to be ultimately due to poisoning of the respiratory system. Blood pressure is increased until very deep narcosis is present, when a fall of

blood pressure occurs. The peripheral vascular dilatation, showing itself in flushing of the skin, together with sweating and roseolous rash, is the cause of this fall of blood pressure. When pushed to an extreme, death occurs and is due to a poisoning of the respiratory centre and to extreme vaso-dilatation, causing death by all the blood draining into the tissues. This is well shown in Figure I. Death

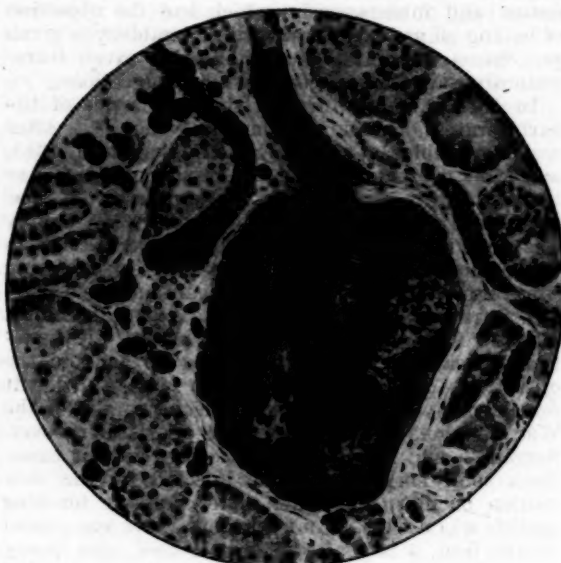


FIGURE I.

occurred in this case under deep ether anaesthesia with flooding of oxygen. The operation was the enucleation of tonsils in a child, and death occurred suddenly when the child had appeared well with a bright pink face, but rapid pulse. *Post mortem* the heart and big vessels were empty. Looking at this photomicrograph, and without knowing that death was due to ether, any physiologist would say it was typical of a death from histamine shock. We have three such cases in the records of Saint Thomas's, and no one would have taken more interest in them than Embley. The question I should have put to him would have been : "Are these deaths histamine deaths due to oxidation of histamine from over oxygenation?" Embley worked out very carefully the effect of ether on the circulation. He found that blood pressure falls if measures are not taken to prevent peripheral dilatation of the vessels, but when ether is given by a closed inhaler, Clover for instance, this fall is corrected by the limitation of air incident to its use, and the maintenance of the tension of carbon dioxide. What a vista of possible scientific research these slides conjure up. This condition in the lungs, for instance, may be, and I think probably is, the cause of those spreading thromboses which are all grouped under the heading "ether pneumonias". The condition may also be conducive of the so-called collapse of the lung which when infected produces pneumonia. Such cases became more common as surgery became more extensive

and deliberate, as the demands of the surgeons became more insistent for relaxation. This relaxation, when attempted with chloroform, was immediately fatal. For years it was considered safe with ether, and then as the surgical demand became greater and greater it was evident that the after effects were dangerous, and other means had to be found to satisfy surgical requirements.

I have slides here showing death from another cause under ether anaesthesia. (Figures II and III.)



FIGURE II.

So far as I know there is only one other record of such a death from fat embolism under anaesthesia.

The patient was a man of rather a flabby type, thirty-five years of age, who had been in bed more or less for over a year unable to walk. The operation was for suture and lengthening the *tendo Achillis*. A student gave him an ordinary straight gas and ether anaesthetic, and I noticed nothing wrong. The operation was done with the man lying face downwards, and when he was turned over for plaster to be put on, it was noticed he was a pale colour. He became restless and was muttering. His colour became worse and I thought he was going to vomit; so certain was I of this that I reassured the surgeon who wanted to know what was wrong. However, there was no vomiting. Restlessness and colour got rapidly worse, and within ten minutes the man was dead.

Death was quite unlike anything I had seen before in a theatre, and was exactly like many deaths I have seen in old people after a prolonged illness—all the same symptoms, and finally the change of colour. I had no idea why that man died at the time, and told the coroner so. It was only a fortnight later when Professor Dudgeon sent for me to see these slides that I knew. The coroner's verdict was: "Death under ether anaesthesia." It was owing to his courtesy that we ever found out the real cause, as he allowed us to have the necessary parts for histological examination. Such a death is uncommon, but many others must have occurred, and that they have not been recognized is due to want of the use of the microscope. It is difficult to believe that

ether could have liberated all this liquid fat into the circulation during the short time of the operation. There must have been several pounds of liquid fat present. One of the chief points of interest in this case is the futility of the coroner's inquiry into the cause of death from a scientific point of view.

That death occurs during operation from air embolism has always been suspected. Dr. Keith Simpson records three cases in the *Guy's Hospital Gazette* (February 16, 1935) proved by careful *post mortem* examination. Without question the condition will now be shown to be more common as the pathologists will recognize the *post mortem* condition. This paper certainly explains several deaths I have seen or heard of on the operating table which have been attributed to the anaesthetic, and what also interests me is that he gives details of the other death from fat embolism during anaesthesia. I have been on the look out for such another case since I first published my case in my presidential address at the Section of Anaesthetics of the Royal Society of Medicine.

Search has been made by many anaesthetists and surgeons for some means of producing relaxation by other means for long periods with safety. By long periods I mean for over an hour, for up to that time ether seems reasonably safe in healthy people.

So far this search has been only moderately successful: in the lower part of the abdomen it can

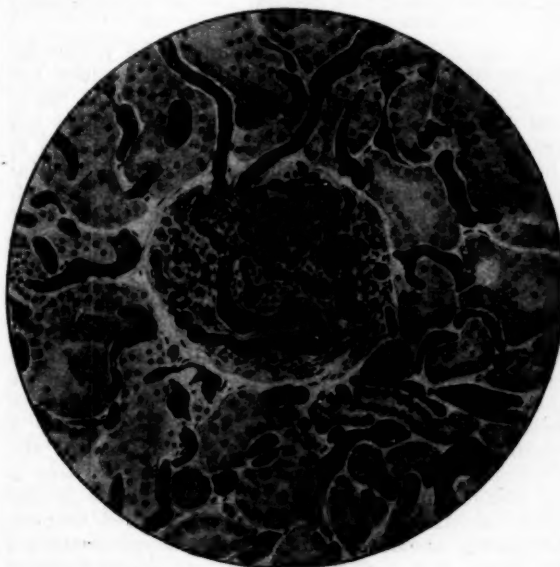


FIGURE III.

be obtained by spinal anaesthesia, which produces the only thing comparable to the relaxation produced by deep ether anaesthesia.

There are no records that I can find that Embley did work on spinal anaesthesia which will produce such wonderful abdominal relaxation. From time to time long papers are written describing the use of some particular technique, and the use of one particular drug to produce anaesthesia in this way,

and undoubtedly in some people's hands spinal anaesthesia gives very good results which other people are unable to obtain. From the early days of "Stovaine", which I first used in 1904, to the present time when dilute, light or heavy solutions of various drugs are used, technique and opinions have varied. Generally it may be said that spinal anaesthesia has found a place amongst anaesthetics and, that when surgeons have been unable to call upon efficient anaesthesia by other means, it is popular. Dilute solutions of "Percaïne" are in favour in London, especially for the lower extremities and abdomen. Smaller doses are being given after preliminary narcotics and under gas and oxygen anaesthesia. Removal of tonsils and such-like operations were published in one series of reported cases. Spinal headache is one of the worst complications which occur, while chest troubles are by no means unusual. The headache can be a serious event when it occurs; as a preventive the Trendelenburg position seems to diminish the incidence. In considering the causation of this headache an interesting case has recently happened in my practice.

The patient, a middle-aged, healthy woman, had severe typical spinal headache. I had given her "Avertin", and the surgeon required complete relaxation. I proposed to give her the minimum dose of "Stovaine" in saline solution, but although I am certain I punctured the theca, I could not obtain any cerebro-spinal fluid, so following my fixed routine, I gave no injection (incidentally the surgeon had the same experience), and finished the anaesthesia with gas and oxygen. That lady had a severe headache for a fortnight, although no cerebro-spinal fluid was withdrawn and no drug was injected.

It has been said that other means of producing anaesthesia have been searched for to replace the older inhalation anaesthetics chloroform and ether, and great advances have been made in the last ten years in this search. I may say I was very glad of the considered opinion of the Council of the Association of Anaesthetists of Great Britain and Ireland, given at the request of the Ministry of Health, that "mixtures of ether and chloroform acted in the same way as dilute chloroform and were in fact more dangerous as they gave a sense of false security". This applies, of course, only to mixtures of the liquids, not their vapour as produced by Walter Tyrell in 1898, on which principle all modern methods are founded. The advance has chiefly been in the use of various drugs as preliminary medication to enable gas and oxygen anaesthesia to produce a condition suitable for surgery and to abolish the psychical effect of fear before operation. There is no doubt that gas and oxygen anaesthesia is the least harmful of all, but if it is attempted without producing anoxæmia and without supplementation by drugs, it is inefficient for any prolonged surgical procedure. Gas is exhaled unchanged, and is not absorbed by the tissues. It can be used over and over again by breathing through soda lime to absorb carbon dioxide from the expired gases; this is a great economy of gas, and is economic both from the quantity used and by making the necessary apparatus more portable. In this connexion Bohr's statement that "lack of CO_2 causes the hæmoglobin of the blood to hold on more tightly to its oxygen" must be remembered. An anaesthetized patient may therefore appear to be properly oxygenated while actually

suffering from anoxæmia. Yandell Henderson has pointed out that carbon dioxide starvation may occur during anaesthesia, and this is more likely to occur when a plenum method is employed. Both these statements, which are fully substantiated, make some form of rebreathing essential, and there is practical evidence of the want of carbon dioxide when using the soda lime circuit for prolonged periods.

The drugs by which this preliminary narcosis or basal narcosis, as it has been called, is obtained are very varied, and may be divided up into the following groups: (1) opium and hyoscyamus derivatives, (2) "Avertin" and paraldehyde, (3) barbiturates. None of these are given as anaesthetics by themselves, but simply as accessories to abolish nervous shock and to enable gas and oxygen to be given either by themselves or with the addition of small quantities of ether. With the exception of Class 1 these are comparatively modern, and have really only come into general use since Embley's Time. Taking them in the above order:

1. Three common forms are in use: Morphine, scopolamine (hyoscyne hydrobromide) and "Omnopon". Their use is well known. The first two were used together and produced that condition which was known by the wonderful name, "twilight sleep". The public at one time was much enthralled by wonderful descriptions of this condition in the lay Press with reference to its use in midwifery. The method has fallen a great deal into disuse owing to its universal use and abuse. It most distinctly has its uses. Two tablets known as "Tabloid Hyoscyne A and B" are on the market made by Burroughs Wellcome and Company, and with them it is quite possible to get a patient to the operating table without his having any recollection of the fact and to procure a very quiet anaesthesia with gas and oxygen, or relaxation with spinal anaesthesia. The disadvantage is that respiration is too shallow to permit sufficient anaesthetic to be inhaled to procure relaxation. "Omnopon" is used in the same way, it having about half the potency of morphine, while it is claimed to produce less sickness and disagreeable after effects. These drugs are used hypodermically and take varying times to act. By using about a quarter of the hypodermic dose, morphine can and is given intravenously, when it acts very quickly and uniformly.

2. "Avertin" and Paraldehyde.—"Avertin" and paraldehyde are the two principal drugs used as basal narcotics by the rectal route.

"Avertin" is the more popular, and has an extensive vogue; it is also the more modern, and was introduced into the British Isles from Germany. Its use is simple; there have been very few fatalities. Patients as a rule like it, and it has few post-operative sequelæ. It is simply tri-brom-ethyl-alcohol, and the solution is very easily prepared. Like every other drug its use needs care. The manufacturers (Bayer) issue comprehensive tables for this purpose, it being given according to the body weight—0.1 gramme per kilogram of body weight is the standard dose. Such a method of estimating the dose can at best be only an arbitrary one. For instance, it

would have been fatal to give the acromegalic doctor of twenty-four stone, whom I had to deal with a short time ago, twenty-four stones' worth of "Avertin"; equally, it would be futile to give an extremely thyreotoxic woman of four and a half stone four and a half stones' worth. The anaesthetist must see the patient first, and bearing in mind the nature of the operation and relying on the standard dose, the "Avertin" weight of each individual must be estimated and the dose given accordingly. Thus the "Avertin" weight of the twenty-four stone patient was estimated at fourteen stone and of the thyreotoxic woman at seven stone. These estimations both worked satisfactorily. It is astonishing how little anaesthetic is required by these people when the dose is correct, but it is better to give too little "Avertin" than too much, as the anaesthesia is so easily controlled after the skin has been incised. The retrograde amnesia is very pronounced, and the patients will even talk apparently rationally without any recollection later on. The solution must be made up freshly for each case and, the rules drawn up by the manufacturers being strictly adhered to, should be given about half an hour before operation. When it was first introduced large doses of morphine or "Omnopon" were advised to be given with it, and I think much of the adverse criticism to "Avertin" was due to their use, as they depressed respiration. I never give morphine before "Avertin" and am very careful of doing so afterwards. "Avertin" lowers the blood pressure, a fact which can be made use of in cerebral surgery, and it is interesting to watch a rise in blood pressure after about an hour during such operations. Frankly I do not like it for abdominal work unless the surgeon is competent and willing to use some means of blocking off the nerves. Some such aid is necessary to secure relaxation of the abdominal muscles. I use it for all orthopaedic work, for which I am constantly giving anaesthetics. That "Avertin" is not so free from after effects as was at one time supposed is now well recognized. Headache, restlessness and vomiting occur, and many people are met who prefer the straight nitrous oxide ether sequence. To one girl I gave three "Avertin" anaesthetics in a week, and after the last she had a condition which was indistinguishable from a mild attack of so-called delayed chloroform poisoning.

"Avertin" has won a place amongst anaesthetic drugs and has come to stay. There are several definite contraindications to its use: (i) The existence or history of any form of colitis, (ii) obstructive interference of the air passages, (iii) premedication with heavy doses of opium.

Paraldehyde is one of the safest drugs we possess, and has a very wide margin of safety. Its objections are its insolubility (one fluid drachm to one and a half fluid ounces of saline solution) and to some people its horrible smell. Again, it is used by body weight one drachm to the stone. It is extremely useful in children and morphine can be used to intensify its action. Lately it has again been used successfully in maternity work and, if given before the head has engaged in the pelvis, when it is possible to inject it high up the rectum, it gives peaceful

sleep, while labour continues unaffected. The babies reek of it, but do not seem unduly sleepy. It has been stated as a contraindication to its use that the babies do not take their food well in the first two weeks of life, and that in a series of cases their increase in weight was not up to the average. In adults for general surgery the bulk of fluid which has to be used makes its use difficult, and it is apt to act as an enema and give uncertain results. It is more soluble in oil, but the absorption is not so good.

Nitrous oxide anaesthesia, with or without oxygen, was of course well known to Embley as it had been in use for many years before his time, and machines were in existence to give more or less accurate mixtures and percentages. Early in this century these percentages had all been worked out by Hewitt, who had a percentage inhaler and was quite cognizant of the value of giving the mixture under pressure, which he recognized as being necessary when using nasal gas and oxygen. The method of controlling the flow of gases was crude. In fact the only way of doing so was to allow them to escape from the storage cylinders into elastic rubber bags. Next, from America came the Gwathmey machine with control reducing valves on the cylinders. It is upon the principles of this machine that all modern gas and oxygen machines were founded. I had one of these early Gwathmeyes, and it is still in use in South Africa. They owed their success to the fact that it was possible to add at will large or small quantities of ether to the mixture of the gases, and made frank recognition that gas and oxygen *per se* as an anaesthetic was futile except for the very shortest and minor surgical procedures. Premedication and the addition of small quantities of ether have made gas and oxygen possible as an anaesthetic, and have enabled the surgeon to operate for hours at a time with impunity. The machines now on sale are innumerable, but they all have this in common, that ether can be added at will and definite known percentages can be given. The newer and more complicated can give a high pressure and rebreathing. Personally I prefer simple apparatus, and I use the simplest form I know. At the other extreme is the latest form of McKesson, which is the Rolls Royce of these machines.

The machine which you have produced in Australia is all that can be desired, and is efficient. The cry which was raised of the expense of the gas and difficulty in transport is now no argument, as it can be used over and over again as long as the expired carbon dioxide is removed by soda lime. An efficient method of doing this is becoming popular in London, chiefly on account of portability, as the cost of gas is not so great as in this country.

There is no question that nitrous oxide is the least toxic of all anaesthetics, but equally without anoxaemia or the use of adjuvants it is the poorest, and relaxation cannot be obtained with its use alone. Scopolamine, morphine and "Omnopon" are all useful in this connexion, but something more is wanting. "Avertin" and paraldehyde have been discussed shortly, but it is in this search for premedication before gas and oxygen that there is such diversity of opinion about the value of the countless forms of barbiturates. Their very multiplicity and complexity

are bewildering; every one is hailed as the best and used by enthusiasts until a fresh one appears. The ideal has not been found, and personally I have no great faith in the group known as the barbiturates producing it. Those of you who can remember the introduction of veronal as a universal hypnotic will remember numerous disasters which were reported from overdosage and idiosyncrasy. Hedonal showed that this same sensitiveness to the drug varied in various people when given intravenously. What is put into a vein is irrecoverable, but I believe the action is more uniform than when given by the mouth, as the drug is more certainly taken into the blood stream unaltered. Administered in this way they are safer, and the disasters which have been reported after the use of veronal by the mouth do not occur. Many of the observations made in 1912-1913 about hedonal can be made about the newer drugs, but the attempt to produce a surgical anaesthesia entirely by their use has almost been abandoned. The chemical formula of all these barbiturates is very similar, in fact it is difficult to distinguish one from the other. Although I have had experience of the majority, I rarely use them now. I prefer scopolamine, morphine, "Avertin" and paraldehyde as being safer and more certain. The barbiturates I have used intravenously are hedonal, "Isopral", "Nembutal", "Pernocton" and "Evipan", in that order. There are many others, but they are given chiefly by the mouth, and of these undoubtedly "Medinal" and others are useful. Embley saw me use hedonal, about which I was enthusiastic at the time; he was certainly interested, but both he and Horsley looked upon it as a passing phase, and they were right.

We pointed out from Saint Thomas's in 1913 that any form of opium should be used only with great care when this class of drug had been used; this is now generally accepted. Before leaving London, I saw several tubes containing another mysterious anaesthetic, another barbiturate said to be much superior to "Evipan"! It had not even been christened, and was only designated by a number.

Professor Haas, of Munich, was in London recently; he told me that he had given up the use of the barbiturates in surgery and was relying upon "Avertin". He told me of a death he had in the removal of an ordinary quiescent appendix from a healthy young woman. "Pernocton" was the drug used. And he told me of dangerous symptoms in other cases when using the same drug. It is rather disturbing to hear such stories about one or another of these drugs from various sources in casual conversation.

The position of the barbiturates remains obscure. It is not at all clear what is going to happen. In the hands of some enthusiasts much better results are obtained than can be obtained by other people, but when seen in action they are not quite all that is claimed for them. Just as thirteen years ago when I was in America I saw the same old difficulties occurring in the hands of experts that I had experienced myself when using less complicated machinery about which there was no need to be so enthusiastic. I saw the very early ethylene anaesthetics, and, good as they

were, I heard the same complaints of the surgeons about want of relaxation, which seemed to me to be amply justified.

Another disadvantage in the use of all basal narcotics is an economic one, as the prolonged sleep, restlessness and then ataxia necessitate special nursing for twenty-four hours.

During the last eleven years there has been a great increase in the use of intratracheal insufflation, and this again has been due to a demand for a prolonged quiet anaesthesia. There has been a decided change in the technique of this method since its introduction into England by Kelly of Liverpool in about the year 1911. It was originally founded on Elsberg's and Meltzer's work in America, and Kelly, when he returned from a visit to the States, designed a machine of a simple form which depended on a current of air containing a known percentage of ether being delivered under pressure at the bifurcation of the trachea. This was done by means of a semi-rigid catheter passed between the vocal cords and down which the current of air, laden with ether, was passed under pressure. Expiration took place through the space in front and behind the catheter and was more or less continuous. From the perfect oxygenation, due to an abnormally clear air-way, long periods of acapnia resulted. I had one of the very early machines which I used at Saint Thomas's, and I had a simple form built on to a table at the National Hospital which was in use until about eighteen months ago. Gradually it became evident that larger sized catheters gave the best results and then, instead of using pressure, respiration was allowed to take place backwards and forwards through these larger catheters through which the anaesthetic vapour is inhaled. Inhalation is rendered possible by the use of an expiratory valve on the delivery tube, and gas and oxygen, either with or without small quantities of ether, is inhaled. These catheters are best passed visually between the cords after anaesthetization, or, as suggested by Magill, a softer variety may be passed blindly down the nose. The knack of doing either is readily attained by practice, but to me it seems better, although the more tedious, to pass the catheter by direct vision down a clean bronchoscope than down a possibly septic nose. These methods are now used most extensively, and I have no hesitation in some of the cerebral work in using dilute chloroform vapour. Here again the enormous length of time required by some surgeons for the most trivial operations negatives the continuous use of ether, and all the basal narcotics have failed in cerebral surgery, with the exception of "Avertin". In the prolonged cases the patients do well when gas and oxygen are inhaled down a catheter with a minimal quantity of ether.

Laryngologists have recently taken exception to this method of anaesthesia, as they claim to have seen cases of permanent damage to the cords. I can well understand that this may be true, though so far I have not had such a case brought to my notice. It is essential before the catheter is passed to have the adductors of the cords paralysed, and this occurs only when anaesthesia is deep. Years ago David Ferrier showed that the abductors were

paralysed before the adductors, leaving the latter unopposed. This means that the catheter should not be passed until the adductors have been paralysed also and are no longer the white glistening structures such as we expect the cords to appear. Cocaine has been used in very high percentages to obtain this effect. I cannot see the necessity for the use of cocaine, as it adds another poisonous drug, and, given sufficient skill and practice in this manoeuvre, it can be dispensed with. It is the paralysis of the vocal cords which gives such a clear air-way when using a deep ether anaesthesia. In fact when the paralysis occurs, as it does very suddenly, it is then, and then only, that the perfect relaxation of this form of anaesthesia occurs. The patients are suddenly given the best and freest air-way they have ever experienced; their lungs are ventilated as they have never been before: there is over-oxygenation of the blood and a loss of carbon dioxide. In this way the very quiet shallow respiration occurs which is associated with deep ether anaesthesia. Indeed the next stage is an apnoea which is liable to be alarming unless properly understood. For short periods this form of anaesthesia appears to be perfectly safe and most satisfactory for those surgeons who are quick over their work. I know many surgeons who rely upon the relaxation of deep ether anaesthesia to get their speed and to attain results free from after complications. These remarks are chiefly applicable to high abdominal surgery, and it is an education to see such rapid experts sewing up a slack peritoneum with a straight needle after doing a difficult gastrectomy in under forty minutes. Speed in these cases (if not in all) is the greatest factor of safety in surgery.

Of recent years in England there has been a popular outcry fostered by the National Birthday Trust Fund, to provide anaesthesia for every woman who is in labour. It is a popular appeal, and one with which every medical man or woman must be in sympathy. Unlike those associated with many popular movements, the people responsible for the fund have endeavoured to determine the best and most practical anaesthetic to entrust to the midwife. A strong committee of the New Obstetrical College in London is now investigating many hundreds of reports from resident medical officers in hospitals, midwives and pupils. The agents chiefly considered are nitrous oxide and chloroform, used as analgesics rather than anaesthetics, and in such a manner that they are self-administered under instruction from a midwife who has herself had special tuition. Nitrous oxide with oxygen has been used for many years for the purpose in the United States of America. It serves its purpose in America for institutional treatment, but is almost impracticable for domiciliary work. Nearly all confinements take place in hospital in the United States of America, whereas the vast majority of labours in the British Isles take place in the patients' homes; so that if nitrous oxide is to be used, a more portable machine is essential. Minnitt, of Liverpool, has attempted to supply the want by means of a more portable machine for the automatic intermittent delivery of nitrous oxide and air to the patient. This machine is now on trial; in the hands

of experts in hospitals it is all that is claimed for it, but it is far from really portable, and the patients need education in its use. At home chloroform has been the almost universal analgesic for midwifery, and came into general use after being given to Queen Victoria during her later confinements—"anaesthesia à la Reine", as it was known for years. The employment of chloroform has the great advantage of portability and simplicity, but it is particularly liable to be pushed too far. Chloroform given to the obstetrical degree has to be fully understood, or it can certainly retard labour and be dangerous. The two methods of giving it which are being chiefly investigated are: (i) chloroform capsules, (ii) Mennell's bottle.

The capsules are of the familiar amyl nitrite form, each containing twenty minims of chloroform, which should be broken on a mask one at a time. The patient then inhales the chloroform, holding the mask near or on her own face. Under supervision the method works well, but the patient cannot be expected to break the capsules herself. The maximum number I have heard of used for one recorded case is a hundred and twenty-nine. This means a big quantity of chloroform, and certainly cannot be considered safe in the hands of the inexperienced, or without danger in the hands of any but real experts. The bottle which goes by my name is a modification of the junker inhaler which I have attempted to make foolproof. That it is so will readily be seen, and, provided the bottle containing the chloroform is not heated, anaesthesia cannot be induced. It can produce analgesia, or what I believe is more important still—amnesia. No method of giving chloroform can be free from the risk of the so-called "delayed chloroform poisoning". In considering this point it must be remembered that the toxæmias of pregnancy very closely simulate this condition and occur when no chloroform has been given. It is interesting to see the differences in the reports from the various centres regarding these methods. It will be equally interesting to see the ultimate opinion as to what should be taught the midwives.

Ethylene, acetylene and other gases of the same group have been used as anaesthetics, but have not gained popularity in England. Cyclopropane is the newest (and at present the most expensive) gas to be tried. Di-vinyl ether or "Vinethene" as it has been called, is said to fill a gap between chloroform and ether. All these anaesthetics are on trial, and may in a few years' time have proved their value and safety sufficiently to be discussed more fully in the next Embley lecture.

What is the outcome of this lecture? There is now a bewildering multiplicity of methods of producing anaesthesia. Embley's plant has become a shrub; one which wants pruning. The undergrowth is overgrown, but the main branches show a healthy growth, and the fruit it bears is already of great assistance to mankind. What this shrub really wants is attention to the roots: more of the spade work put in by men like Embley the physiologist to determine the exact action of all these drugs, and to tell us the nature of this condition which we know as anaesthesia.

From a practical standpoint as an anaesthetist of many years' experience, the message I should give in conclusion is: Keep a clear air-way; use as simple machinery as is compatible with efficiency, and remember that even in this mechanical age there has to be human control of the machine. It is the man behind the machine that counts in anaesthesia.

THE MANAGEMENT OF HEAD INJURIES.¹

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DEFINITION.

THE term "head injury" is now a very comprehensive one, and numerous clinical states are included among its manifestations. With the advance of the modern mechanized industrial era, the advent of the internal combustion engine, and the craze for ever speedier transport, head injuries are increasing in frequency, and an understanding of their protean results is of vital importance.

The following pathological conditions are regarded as being covered by the term "head injury": (i) wounds and contusions of the scalp; (ii) fractures of the skull and their complications; (iii) meningeal and vascular injuries, leading to the various types of intracranial hæmorrhage—epidural, subdural, subarachnoid and intracerebral; (iv) contusions and lacerations of the brain, with œdema and/or hæmorrhage, leading to the clinical states of traumatic stupor and traumatic delirium (that is, concussion, irritation and compression of the brain); (v) the after-effects of any of the above, including mental deterioration, traumatic neurasthenia and fits.

SOME SPECIAL CONSIDERATIONS.

No attempt will be made to discuss the above-mentioned conditions in detail; but the following points are stressed.

1. Any or all of the above states may be produced without an initial loss of consciousness.

2. If consciousness has been lost, for however short a period, then primary traumatic stupor or concussion of the brain has occurred.

3. A consideration of the case, on the basis of the traumatic stupor produced, is more important than on the basis of fracture. In other words, it is the degree of the injury to the contents, and not the container, which matters. A fracture may bring about decompression with beneficial effects.

4. The longer the initial loss of consciousness, the more serious is the damage incurred by the brain.

5. The severity of the initial injury affords no indications concerning the occurrence of trouble-

some sequelæ, which frequently follow injuries which did not produce any loss of consciousness, as is seen from Cases XII, XIII and XIV.

6. Sequelæ are usually due to the formation of cicatricial gliosis and adhesions; their onset may be delayed till years later, and frequently depends on the adequacy or not of the initial treatment.

7. The persistence of headache and "dopiness" should not be lightly dismissed as traumatic neurasthenia, lest a state of chronic cerebral œdema supervene, followed by cortical atrophy, due to the increased cerebro-spinal fluid and intracranial tension, as seen in Case VI.

8. Conversely, these symptoms, and traumatic delirium as well, may occur with a persistently low pressure of the cerebro-spinal fluid, and a relative anoxæmia. The intelligent use of a simple spinal manometer will distinguish these cases and check the wholesale and unnecessary dehydrations which are equally contraindicated in acute hæmorrhages.

9. Traumatic stupor and lengthy unconsciousness are not necessarily due to increased intracranial tension. In some cases of posterior fossa tumour the intracranial tension far exceeds any found in traumatic cases, yet the patient is not stuporous. Stupor is usually due to contusion, especially polar and *contre-coup* contusion of the anterior portions of the hemispheres, as is seen from Case IV.

10. Restlessness, sham rage and anosmia indicate lesions on the under-surface of the frontal lobes; incontinence may mean a lesion further back in the middle frontal gyrus; and aphasia, indicative of a left-sided frontal or temporal contusion, may account for the apparent stupor of many patients for lengthy periods.

11. The onset of secondary traumatic stupor after a lucid interval of varying duration usually means compression of the brain, with increased intracranial tension, and may be due to an extensive subdural hæmorrhage as well as the more often recognized condition of cerebral œdema, and the classical syndromé of extradural hæmorrhage.

12. Bradycardia frequently occurs and persists for many days without any evidence of compression and without increased intracranial tension as recorded by manometer. Alterations of pulse rate, either faster or slower, are not as important as alterations in the systolic and diastolic blood pressures, as seen in Case III.

13. Finally, early death is usually due to gross compression; but death occurring later is often due to damage to nerve cells and tracts by necrosis, in which choline and histamine may play a part. Injury to the subthalamic nuclei of the vegetative nervous system may be as serious as to the vital centres of the medulla, and lead to serious metabolic disturbances and fatal thermal crises.

CLINICAL GROUPS.

A consideration of any large series of head injuries on the basis of traumatic stupor will enable them to be placed in three categories,

¹ Read at a meeting of the Western Medical Association held at Cowra on July 17, 1935.

according to their condition on admission to hospital.

Group I.

Group I consists of patients who are deeply unconscious or comatose. These comprise chiefly cases of injury to the base of the skull with rapid and extensive subarachnoid hæmorrhages and hæmorrhages from the dural sinuses. The patient's condition becomes progressively worse whatever is done, and death occurs within the first twenty-four hours, and usually within the first eight hours. Out of a total of 600 consecutive cases of acute head injury treated at the Royal Prince Alfred Hospital there were 80 deaths, 63 of which occurred within twenty-four hours of admission (80%), five occurred during the second day, and three each on the third, fourth and fifth days, and only two thereafter. Only 62 patients were classified as comatose on admission, and another 12 were regarded as indeterminate.

The rapidity of death, and not the mortality rate, is the important factor in assessing the results of treatment of head injuries.

Group II.

In the second group patients are of two main types.

1. Patients who have regained or are already regaining consciousness, but are dazed and restless, with immediate retrograde amnesia; 330 cases fell into this category. Provided a progressive return of the faculties proceeds, the prognosis is good, whatever the injury.

2. Patients who were primarily unconscious, but have recovered and relapsed into a secondary unconsciousness or stupor. Unless careful observations have been made on admission, or shortly afterwards, it may be difficult to estimate the length of the lucid interval, the depth of this secondary stupor (the crucial point) and the existence of localizing signs. The classical cases of extradural and massive subdural hæmorrhage fall into this group, and for them active operative intervention (subtemporal craniectomy, often bilateral) is essential. If the stupor is relatively light and no paralysis is observed, œdema only may be present, and recovery will occur spontaneously or by the aid of dehydration methods without major operation. Only six cases of this sub-group were recognized.

Group III.

Patients who are stuporous or lightly unconscious on admission to hospital and who remain uncooperative and unresponsive for hours, days or weeks; 238 cases comprised this group. Despite this lack of cooperation, many useful observations and examinations can be made. The condition of the patients, thus revealed, is a gradual and progressive one towards recovery; anxiety will be relieved, and there is no need for major surgical intervention. These are usually cases of severer contusions and lacerations.

CLINICAL OBSERVATIONS.

To place patients in these groups, it will be realized that careful observations must be made, recorded, and repeated at frequent intervals. The following are most essential:

(i) *History* (from the patient if conscious, otherwise from witnesses): (a) The nature of the injury. (b) Any immediate loss of consciousness (primary stupor) and its duration. (c) Retrograde amnesia. (d) Lucid interval and secondary loss of consciousness.

(ii) *Present Symptoms* (if conscious): (a) Headache. (b) Vomiting, especially of blood. (c) Eyesight. (d) Smell. (e) Hearing.

(iii) *State of Consciousness* (recorded every hour) in five degrees, namely: (a) Consciousness. (b) Drowsiness—indicated by response to a tactile stimulus, such as taking the temperature, and pulse rate. (c) Stupor—indicated by response to a vocal stimulus. (d) Deep stupor—indicated by response to a painful stimulus only. (e) Coma—all stimuli fail to produce a response.

(iv) *Attitudes in Bed*: Restlessness, "fighting drunk", flexion or extension.

(v) *Examination of Scalp and Cranium for Local Injuries*.

(vi) *Examination of Cavities and Orifices* (orbits, nares, mouth and ears).

(vii) *Cranial Nerves*, especially pupils and fundi.

(viii) *Limbs*: Plegias and anæsthesias, spasticity, Kernig's sign.

(ix) *Reflexes*: Abdominal, knee and plantar reflexes, ankle clonus.

(x) *Sphincters*: Deglutition, micturition, defæcation.

(xi) *Hourly Charts*: (a) Temperature (bilateral axillary or rectal). (b) Pulse rate and rhythm. (c) Respiration rate and rhythm. (d) Blood pressures.

(xii) *Examination of the Urine*.

(xiii) *X Ray Examination of the Skull* (antero-posteriorly and laterally).

The management of head injuries causes more anxiety than any other emergency of practice, and the prognosis in the early stages is quite uncertain. Each case will be a law unto itself and will differ from the previous one in the manner of its development. A clear understanding of the progress of the case and of the varied pathological processes which may follow, and the application of successful treatment, will depend on the above careful and continuous observation of the symptoms and signs arising during the danger period, that is, the first forty-eight hours.

EMERGENCY TREATMENT.

Emergency treatment is very important, lest harm be done by unnecessary interference. The unconscious patient has usually been removed to the nearest shelter. If he is collapsed, it may be advisable to delay further removal until he has rallied a little. Stimulants should be avoided; but warmth may be applied. If there is bleeding from the scalp, it should be controlled with an antiseptic pad and bandage, using a padded ring as a tourniquet, or by digital pressure, if there is arterial bleeding. A rapid search for fractures of the limbs should be made and splints applied to prevent further shock. Should signs of increasing collapse appear at this stage, the case is usually hopeless. It is most important that the next move should be direct to a hospital with an X ray plant and

facilities for efficient nursing and dealing with any intracranial emergency which may arise, requiring careful observations and even operation. It is advisable to examine the skull radiographically immediately on the patient's arrival, before he is put to bed, to avoid further undue movements later.

TREATMENT IN HOSPITAL.

Rest in Bed.

Apart from the care of the open wounds and compound fractures, the early treatment of head injuries is conservative. The patient should be placed in a warm bed in a quiet, darkened room. Absolute rest is the most important aid that can be given. Nature's efforts to compensate for increasing intracranial tension. In the above-mentioned series at the Royal Prince Alfred Hospital, 507 patients (85%) recovered without any operative treatment and 70 died. Only 23 patients were operated upon; of these, 13 survived (an additional 2% of the whole number); the remaining 10 died, making 80 deaths in all, that is, a mortality rate of 13%. These figures compare more than favourably with those of Dandy, who states that only 70% of patients with head injury recover with conservative treatment alone, and that 10% of the remainder may be saved by operation, leaving a 20% mortality rate. Every person who has lost consciousness, no matter how mild the injury, should be put to bed and kept at rest until all signs and symptoms, especially headache, have disappeared and the chart has been normal for forty-eight hours. Even when the patient is allowed out of bed, work and exercise should be only gradually undertaken and should be limited by the production of headache and other "effort" symptoms.

Posture and Nursing.

During the initial stage of collapse the patient should be kept flat on the back, with the head turned to one side to insure a free airway. As soon as this stage is over, and even while the patient is still unconscious, the head and trunk should be raised to an angle of about 30°, to aid the venous return and relieve congestion. This is most conveniently done by using a special Lawson Tait type of bed, on which the patient can be postured, right up into the Fowler position or any intermediate position. The use of pillows, back-rests and blocks under the head of the bed will achieve the same purpose, but not so readily.

While the patient is unconscious, four-hourly changes of posture, from back to side, to back again *et cetera*, should be made to avoid pressure sores and hypostatic pneumonia. Inhalations of oxygen and carbon dioxide gas mixtures are useful to aid ventilation of the lungs and prevent retention of secretions.

Observations and Classification.

As soon as the patient is arranged comfortably in bed, the history should be taken by the nurse or doctor, and careful examination made of the central nervous system, and the regular observations started which have already been listed. A note of the state

of consciousness and the other observations should be written down every hour. During the initial examination an attempt should be made to place the patient in one or other of the clinical groups previously described, so that some idea of the prognosis may be made. Multiple injuries should be borne in mind and sought for.

Quite recently two cases of this character were met with and the difficulties they presented can be realized from the following notes:

CASE I.—A male, aged twelve years, sustained a fracture of the occipital bone with subarachnoid hæmorrhage and a compound fracture-separation of the epiphysis of the lower end of his left femur when he was knocked down by a motor car. He was very shocked, but later became very restless. Lumbar puncture was performed and a quantity of heavily blood-stained cerebro-spinal fluid was allowed to run off until the pressure was normal. A spinal anæsthetic was then introduced, which enabled the fracture-separation to be reduced, the wound to be sutured, and an unpadded plaster spica to be applied. No further restlessness occurred, although headaches persisted for some weeks. A perfect result, both anatomical and functional, was obtained in the left thigh.

CASE II.—A male, aged fifteen years, was knocked down by a tram and sustained a fracture of his occipital bone with severe subarachnoid hæmorrhage and a compound fracture of both bones of the right leg. He was very collapsed, but later became extremely restless with a tender and rigid abdominal wall. He was given a blood transfusion and, under nitrous oxide and oxygen anæsthesia, lumbar puncture was performed and heavily blood-stained cerebro-spinal fluid was evacuated until the pressure had fallen from 500 to 100 millimetres of water. A subumbilical incision was then made and a coil of jejunum was found badly torn; the peritoneal cavity was full of intestinal fluids. Enterectomy, with side-to-side anastomosis, was carried out, and then the compound fracture was reduced, the skin edges excised and sutured, and an unpadded plaster cast applied.

The patient's irritability continued, and lumbar puncture was necessary on two subsequent occasions before the fluid pressure became normal. Unfortunately peritonitis occurred, with secondary intestinal obstruction, and, despite jejunostomy, resection of further obstructed loops of bowel with fresh anastomoses, and the formation and closure of several intestinal fistule, the patient gradually starved to death, ten weeks after the injury.

Prevention of Infection.

Wounds of the scalp not communicating with the skull bones should be cleaned with warm saline solution. Ragged edges should be excised and then sutured and dressings of *Tinctura Benzoinæ Composita* applied. Compound fractures of the vault require immediate or early operative treatment, which will be described later. Leakage of cerebro-spinal fluid and/or blood from the nose or ears indicates a compound fracture of the base of the skull, with the risk of meningitis. The anterior nares should be kept free from clot, and some antiseptic drops, such as the Royal Prince Alfred Hospital "*Guttæ Nasalis*", instilled at frequent intervals. The external ear should be swabbed, never syringed, with a mild antiseptic, such as a 1 in 1,000 solution of perchloride of mercury in water, and then lightly plugged with a pledget of gauze soaked in the same solution; the pledget should be changed hourly. Hexamine by the mouth may help to prevent meningitis.

Restlessness and Irritability.

Restlessness and irritability will occur during the stage of recovery from the concussion and cerebral irritation. Headache and photophobia are common too. The bed should be placed against the wall or rails put around it, and the room kept darkened. The patient may try to get out of bed; but mechanical restraints often only increase the irritability and should be avoided if possible. Good nursing helps a great deal at this stage. It must be made sure that the bladder and rectum are empty. If all else fails, manacles and sheets may have to be employed. Morphine should be avoided at all costs. It depresses the respiratory and the vital centres of the hypothalamus and medulla, especially after trauma, and may mask a relapse into unconsciousness. The ordinary aspirin, phenacetin, caffeine and bromide mixture is excellent given by mouth; or bromides and chloral may be given *per rectum* in larger amounts. Recently the barbiturates have proved effective, especially "Nembutal" and "Dial", which are now available for parenteral administration. A good dose of calomel, followed eight hours later by magnesium sulphate by mouth, should produce a copious liquid stool, which will relieve the congestion and headache tremendously.

Feeding and the Care of the Mouth.

Nothing should be given by mouth to an unconscious patient or to one who has any difficulty in swallowing. The feedings should be given by a nasal or oesophageal tube, lest inhalation bronchopneumonia occur. As consciousness returns the patient is given a moist swab or sponge to suck; later, he is fed with a dropper or spoon, and only when quite conscious with a feeding cup. The mouth, however, will need frequent swabbing and cleansing. Additional fluids may be given *per rectum*. Excessive salivation and frothy mucus in the pharynx may be troublesome and should be removed by suction from the pharynx and larynx, via a nasal catheter, or from the cheek after the patient has been turned on his side. In severe and very prolonged cases it may be necessary to posture the patient in the face-down position, on an operating table with a special head attachment, for lengthy periods.

Hyperthermia.

Hyperthermia may be a worrying and alarming complication, especially a thermal crisis. Some rise of temperature will always occur. Up to 38.8° C. (102° F.) "compensation" is taking place; but readings above that should act as danger signals, indicating the onset of compression with damage to the subthalamic and medullary centres. High temperatures cause injury to the neurones of the brain and must be reduced at all costs. The following routine is advocated.

When the temperature is between 37.7° and 38.8° C. (100° and 102° F.), cover with only one blanket.

When the temperature reaches 38.8° C. (102° F.), cover with only one sheet.

When the temperature reaches 39.4° C. (103° F.), sponge with tepid water.

When the temperature reaches 40° C. (104° F.), sponge with cold water.

When the temperature reaches 40.5° C. (105° F.), sponge with iced water.

When the temperature reaches 41.1° C. (106° F.), cover with cold wet sheets and expose to a draught.

When the temperature is over 41.1° C. (106° F.), pack around with ice or place in ice bath.

The Indications for Lumbar Puncture and the Administration of Hypertonic Solutions.

Lumbar puncture may be employed as either a diagnostic or a therapeutic procedure. In the early stages of a head injury it may be important to determine: (i) the state of the intracranial tension (this can readily be measured by attaching to the needle a glass manometer, such as Greenfield's, or a simple piece of graduated millimetre-bore glass tubing with a "Record" fitting); (ii) the presence or absence of free blood in the cerebro-spinal fluid. Its chief therapeutic use occurs in cases of diffuse subarachnoid hæmorrhage, with severe traumatic delirium, that is, of the "fighting drunk" type, when great relief follows the removal of the irritating blood, which itself acts as a stimulus to the production of cerebro-spinal fluid; but the pressure should not be reduced below 100 millimetres of cerebro-spinal fluid. The effect of this was well seen in both Cases I and II, already discussed. It is valueless in cases of cerebral compression due to extradural or subdural hæmorrhage, except to confirm the increased intracranial tension and the absence of blood (in the uncomplicated cases) and to afford temporary relief whilst preparations are being made for operation, although this object may be better attained by the use of hypertonic solutions. In cases of increased intracranial tension due to cerebral oedema, fluid may be withdrawn by lumbar puncture slowly, and carefully controlled by manometric readings. This procedure may be repeated from time to time if the tension rises again. But this is disturbing to the patient, and once the diagnosis has been made by lumbar puncture the use of hypertonic solutions is preferred, the state of the intracranial tension being estimated approximately by taking blood pressure readings.

After the initial stages of head injuries lumbar puncture is valuable diagnostically to determine those cases of irritability (traumatic delirium) and lengthy unconsciousness (traumatic stupor) with a low intracranial tension. These groups were mentioned under "Special Considerations" and have come to be recognized only recently by the routine use of the manometer. The delirium is here due to the products of cerebral contusion and a moderate degree of oxygen-want stimulating the nerve cells, especially of the subthalamic nuclei, whilst the prolonged stupor may be due to contusion and brain damage alone, without gross hæmorrhage and in the absence of compression and increased intracranial tension. The recognition of these conditions is most important, because then, of course, all "dehydratory" and operative procedures are contraindicated, as the following cases illustrate.

CASE III.—A boy, aged fourteen years, had a fall and was unconscious for about fifteen minutes and had amnesia for two hours. He received several lacerated wounds of the face, which healed later by second intention.

During the week after the accident there was drowsiness alternating with transient mild delirium. No other evidence of damage to his central nervous system was detected. Clear fluid was obtained at lumbar puncture and the pressure was not increased. On account of the drowsiness and a persistent bradykinesia and bradycardia, to 50 beats per minute, 250 cubic centimetres of a 50% solution of magnesium sulphate were given *per rectum* daily. The systolic blood pressure was only 110 millimetres of mercury. Discontinuance of the dehydratory treatment and upright posturing were advised, with gradual improvement.

CASE IV.—A female, aged twenty-eight years, was injured when a motor car turned over; she sustained a compound linear fracture of the right parietal bone. She was deeply unconscious for six weeks, with bradycardia to 50 beats per minute. There were then no localizing signs of damage to the brain. The depth of unconsciousness gradually became less and she was extremely irritable and restless. Her speech was incoherent. At the same time paralysis of the left upper and paresis of the left lower extremity were noticed; these conditions varied from spasticity to flaccidity. Lumbar puncture yielded fluid with a few old red blood cells in it, at a pressure of 80 millimetres of water. In view of the localizing signs, a right temporo-parietal bone flap was raised. The *dura mater* was quite normal, but the pia-arachnoid and the cortex appeared to be *en aspic*.

No marked change occurred in the patient's condition, and for a further six months she remained stuporous and uncooperative, with occasional short lucid intervals. She was emotional, at times crying. Her speech was a low, monotonous and incoherent jargon. The power in the lower extremity returned, but a complete left upper flaccid monoplegia developed.

Then one day she became very restless and violent and exhibited "rage storms"; her menstrual flow reappeared and her mental condition cleared up completely, after a nine months' period of amnesia. She rapidly regained full power in her left upper extremity, and is now quite normal, except for some lack of self-confidence in walking.

This case is regarded as one of very persistent diencephalic and frontal lobe contusions.

Finally, lumbar puncture is indicated both diagnostically and therapeutically when meningitis is suspected after a fracture of the skull, or pyocephalus, should an abscess following a retained foreign body or from some other cause, rupture into a ventricle. By the administration intravenously of hypotonic saline solution (0.45% sodium chloride) continuous drainage can be maintained from ordinary lumbar puncture needles or by means of portion of a ureteral catheter inserted down an extra large lumbar puncture needle. This procedure was employed, but without success, in the following case.

CASE V.—A male, aged thirty-seven years, was accidentally shot. The bullet, entering his right temporal region, did not come out. The frontal bone was badly fractured and the sinus of entry discharged old blood, pus and some dead bone during the eight weeks he was in hospital. By this time it had healed and he was sent home free of all symptoms. Three weeks later he suddenly felt a severe frontal headache, vomited frequently and became delirious. He was admitted to hospital with a temperature of 39.9° C. (103° F.), a pulse rate of 140 per minute, and a respiration rate of 45 per minute. He was unconscious and cyanosed. There were generalized twitchings of all limbs and signs of acute meningitis. There were 24,000 leucocytes per cubic millimetre of blood. The cerebro-spinal fluid was under a pressure of 300 millimetres of

water; it was turbid and contained pus. Pneumococci grew on culture. X ray examination revealed the old fracture of the skull and several foreign bodies (splintered pieces of bullet) in the left frontal lobe. Antiserum was given intramuscularly. Hypotonic saline solution (0.45%) was given intravenously, and continuous lumbar drainage was maintained; but death occurred thirty-six hours later, due to meningitis and pyocephalus from a ruptured cerebral abscess.

The administration of hypertonic solutions formed a definite advance in the treatment of head injuries when first introduced. As shown originally by Weed, the increased tonicity of the plasma promoted the resorption of cerebro-spinal fluid and lowered the intracranial tension. Thus the rise of pressure which follows the injury may be combated, the headaches and irritability may be relieved, and the stupor, produced by cerebral oedema, lessened. But recently these therapeutic measures, valuable at the right time and place, have come in for much criticism, chiefly due to misplaced enthusiasm. Indeed, Dandy deprecates their use entirely and says: "No patient has ever been saved by either method" (hypertonic solutions or lumbar puncture). Jefferson disagrees with the "whole-hearted dehydrators" who give hypertonic treatment in all cases of contusion and laceration as a sort of panacea and who use them to replace operation in cases of clot compression, which they never can. Nor should they ever be employed whilst active bleeding is occurring, because they shrink the brain and allow more space into which hemorrhage may occur.

Most mild cases respond to a saline purge, the upright posture, and quiet in a dark room, or else about 180 cubic centimetres (six ounces) of a 25% solution of magnesium sulphate, run slowly, high into the rectum, with restriction of fluids by mouth. The chief indication for the use of hypertonic solutions is during the stage of secondary oedema, from the second and third day onwards, as indicated by high manometric readings on lumbar puncture. In these cases the administration intravenously of 70 cubic centimetres of 15% sodium chloride solution or 50 to 100 cubic centimetres of 50% glucose solution will break the vicious circle (of contusion, oedema, rise of intracranial tension, venous congestion *et cetera*) and dissipate the state of persistent cerebral oedema and cortical atrophy, with its train of troublesome sequelae. The following case illustrates this point very well.

CASE VI.—A male, aged forty-one years, tripped on some steps and hit his head on a wall. He did not lose consciousness, although he had a transient amnesia for a few minutes and was somewhat dazed for about two days. Ever since, for a period of eight months, he had suffered from headaches, spreading up from the occiput to the vertex and the temples. He was unable to concentrate on his work. Mental and any other effort made the headaches worse. X ray examination did not reveal any fracture, and there were no abnormal neurological signs, except blurring of his fundi. However, lumbar puncture yielded clear fluid under an increased tension of 220 millimetres of water; this was allowed to flow until the pressure was 90 millimetres of water, and then 100 cubic centimetres of 50% glucose solution were given intravenously. Great relief was experienced from this procedure. Six weeks later headaches were still present,

though less severe. The pressure of the cerebro-spinal fluid was 180 millimetres of water. This was reduced to 80 millimetres of water, and 100 cubic centimetres of 50% glucose solution were again given intravenously, with complete relief.

This case was one of persistent cerebral contusion with generalized oedema, but might easily have been regarded as traumatic neurasthenia in the absence of manometric controls.

In some recent cases of severe contusion the intravenous administration of 100 cubic centimetres of 50% glucose solution has been found very beneficial, especially where changes in personality, delusions, and extreme restlessness, almost equivalent to *delirium tremens*, have followed injuries, chiefly to the frontal lobes, without any gross compression and only slightly raised or normal intracranial tension. These cases probably have an associated injury to the hypothalamic centres, with disturbances of metabolism and water balance, and rage storms, upon which the nutritional value of the glucose may have a good effect. The following two cases serve to illustrate these points.

CASE VII.—A female, aged twenty-two years, sustained a compound fracture of the left fronto-parietal region and laceration of the brain when she was kicked by a horse. She was unconscious for five days, during which time lumbar puncture twice yielded blood-stained cerebro-spinal fluid under pressure. After regaining consciousness her mental state was quite changed. She was restless, cunning and extremely emotional, and had delusions. Five weeks later she suffered a relapse and became stuporous again. She developed pneumonia, from which she recovered; but her mental condition then became very elated. All her acquired inhibitions were removed; she was extremely erotic and exhibited frequent rage storms. There were no abnormal neurological findings; but her fundi were slightly blurred and the cerebro-spinal fluid pressure was 240 millimetres of water. This was reduced to 80 millimetres of water, and 100 cubic centimetres of 50% glucose solution were given intravenously with some improvement.

A week later the intracranial tension was 180 millimetres of water, and the same procedure was repeated on two subsequent occasions, with complete recovery ten weeks after the accident. Her mental condition has remained normal since.

CASE VIII.—A male, aged twenty-eight years, was unconscious for two weeks with a compound fracture of his right frontal bone and sinus. He had a lucid interval of four days and then became extremely violent and irritable. He was noisy and blasphemous and used very bad language. There were periods of secondary stupor alternating with the periods of delirium. His habits were dirty and he became very emaciated. He was placed in a quiet dark room and "twilight sleep" was produced with "Dial" administered intramuscularly. He was given extra nourishment by the mouth, and 100 cubic centimetres of 50% glucose solution intravenously. Gradually his mental condition improved and he put on weight, although anosmia persisted. A mild osteomyelitis developed in the right frontal bone, in the region of the frontal sinus, from which several sequestra were removed. He left hospital, cured, four months later.

Finally, a word of warning should be uttered against the administration of large amounts of hypertonic solutions, especially when not controlled by manometric readings. The following case illustrates these dangers and some of the ill-effects which follow excessive dehydration.

CASE IX.—A male, aged twenty-one years, received a compound depressed fracture of the left temporal region when his bicycle collided with a motor car. After a lucid interval of twelve hours there was a rapid onset of

deep secondary stupor and right-sided hemiplegia, with unequal pupils. Lumbar puncture revealed blood-stained cerebro-spinal fluid under increased pressure, not recorded by manometer. He was given 200 cubic centimetres of 15% saline solution intravenously; immediate operation was undertaken. The depressed bone was removed and a huge epidural blood clot evacuated after the middle meningeal artery had been tied. The *dura mater* appeared to be intact; but the brain did not expand to fill up the space. Five hours later his temperature was 41.1° C. (106° F.) and his pulse rate up to 130 per minute. Heavily blood-stained cerebro-spinal fluid was withdrawn; but the pressure again was not recorded. He was given a further 150 cubic centimetres of 15% saline solution intravenously. Three hours later he had violent convulsions, his temperature rose to 42.7° C. (109° F.), the pulse rate became 160 per minute, and he died. The wound was explored and no further epidural clot was found. Death was probably due to intraventricular hæmorrhage after excessive dehydration.

Treatment by Operation: Indications and Technique.

Scalp Wounds and Compound Fractures.

Scalp wounds and all compound fractures of the cranial vault require immediate operation to prevent or combat infection which may produce osteomyelitis of the skull, extradural abscess, meningitis, or cerebral abscess. The patient should be taken to the operating theatre on the stretcher or in his bed; the scalp should be shaved widely and cleaned with an antiseptic—either a spirituous or aqueous solution of perchloride of mercury, 1 in 500. Local infiltration anæsthesia with 1% "Novocain" solution should be employed whenever possible. Unless the edges of the wound are clean-cut they should be excised; fragments of dirt, foreign body, hair *et cetera*, should be removed, and the underlying bone examined. A fissured fracture needs no further treatment and the scalp wound may be closed with interrupted sutures and dried dressings applied. If there is any overlapping of the edges a burr or trephine hole should be made and the under surface of the fracture examined. At the moment of injury, dirt or foreign body may have been pressed in between the broken edges of the skull and buried between skull and *dura mater* after the rebound of the bone. Single areas of bone which are depressed should be elevated in the usual way. A good exposure is necessary so that elevation can be done under vision, to prevent damage to blood vessels of the cortex and meninges from sharp spicules of bone, with resultant hæmorrhage. All comminuted fragments of depressed bone, or fragments obviously soiled and unlikely to live, should be removed with bone forceps and nibblers, lest intractable osteomyelitis follow. Hæmorrhage should be stopped with wax or muscle or silver clips. A careful inspection of the *dura* should then be made. If intact, it should not be opened; but if it is torn, the underlying brain should be examined and old clots, dirt and foreign bodies should be removed with forceps or flushed out with warm Ringer's solution from a glass "Asepto" syringe. Lacerated edges should be excised and the *dura* then closed, and a rubber tissue drain placed down to it before the scalp wound is sutured.

Iodine, aristol and dry dressings are applied and kept securely in place with starch or plaster of Paris

bandages, because during the stage of irritability the patient may endeavour to pull the dressings off. Tetanus antiserum, and in very dirty cases gas gangrene antiserum, should be given.

The question of foreign bodies placed superficially or deep in the brain substance, especially at some distance from the site of fracture, needs some further consideration. It used to be considered unwise to search for them, especially if in "silent areas", and sufficient merely to irrigate the track gently with saline solution or an antiseptic via a catheter. But they must always remain a source of potential sepsis, with the formation of cerebral abscess and its fatal sequel of pyocephalus, as occurred in Case V; hence their removal should be attempted as soon as the immediate danger to life is over, unless vital structures would be damaged in so doing.

The defect in the vault which follows removal of depressed fragments of bone should not be dealt with until the wound has been securely healed for six months. The relationship of these defects to post-traumatic disturbances is a debatable one. Cortico-meningeal adhesions and a spreading gliosis are usually responsible for fits and any other symptoms which occur. To obtain relief, the affected portion of brain must be carefully excised. This may be impossible, especially if the affected part is in the left frontal lobe anywhere near the Rolandic area. Frequently, however, the filling in of the defect will bring about considerable and permanent improvement. These defects are particularly susceptible to variation in extracranial (barometric) and intracranial pressure, and slight injury to them may initiate unpleasant sensations or even a fit. Headache may be centred around the area and an unpleasant consciousness of weakness there exist. Psychologically they have a bad influence on the patient who has an inferiority complex. He becomes a source of wonder and an object of pity among his fellows, and feels compelled to wear a special cap and shield lest the brain be damaged. He is always regarded as a candidate for epilepsy or insanity. If a silver plate or piece of celluloid be used to fill the gap there is always a risk of sepsis, and the patient becomes a greater object for amazement than ever, and commands even more sympathy. The bones, being formed in membrane, can never regenerate. Undoubtedly the best plan is to fill in the gap with a bone graft; the inner table of the ilium bone lends itself excellently for this purpose. The advantages and technique of this method were described by Pickerill (*THE MEDICAL JOURNAL OF AUSTRALIA*, August 22, 1931, page 228) and two cases have already been reported by the author (*THE MEDICAL JOURNAL OF AUSTRALIA*, August 27, 1932, page 269). Since then two more cases, with the following interesting histories, have been successfully completed.

CASE X.—A male, aged fourteen years, was kicked by a horse, and sustained a compound comminuted and depressed fracture of the left frontal region. The lacerated edges of the wound were excised and loose, and depressed fragments of bone were removed, together with lacerated brain tissue. The wound was sutured and healed primarily.

There were no troublesome sequelæ; but a slight *hernia cerebri* was present. The boy was becoming introspective; he was not allowed to play games and was made to wear a large metal plate inside his cap. Eighteen months later a gap could be seen and felt in the left frontal bone, about six by four centimetres. This was filled in by a bone graft from the inner table of the right ilium bone, after the scalp had been dissected back and the dura freed from the edges of the gap.

When seen one year later the graft was quite firm and solid; no pulsations could be detected, and the boy was leading a normal life.

CASE XI.—A male, aged twenty years, was injured in a motor car accident. After a lucid interval of three days he developed signs of compression due to middle meningeal hæmorrhage on his left side. Subtemporal decompression was performed and he regained consciousness next day; but aphasia and hemiplegia were present and took some weeks to clear up. About seven months later he had a Jacksonian epileptic fit, beginning in the right side of his tongue. Fits recurred at frequent intervals and his mental condition was deteriorating. Encephalography indicated the presence of adhesions and gliosis at the site of the decompression. At a second operation the scalp tissues and temporal muscle were freed from the *dura mater*, which was found to be adherent to the brain, and not disturbed. A bone graft from the right ilium was inserted to fill in the gap and the wound was closed. Some months later his mental condition had improved considerably and the fits were of much less frequent occurrence.

Simple Depressed Fractures.

Simple depressed fractures should be elevated as soon as possible and before any troublesome sequelæ are produced. How soon and how severely these may occur is well shown in the following case.

CASE XII.—A male, aged seventeen years, was kicked on the head whilst playing football. He was dazed, but did not lose consciousness, and played on for about fifteen minutes till the game had finished. He was then taken to hospital and whilst in the casualty department he took a generalized fit, during which his head and eyes were deviated to the right and his temperature rose to 42.2° C. (108° F.). Lumbar puncture yielded clear fluid under pressure (not recorded). A simple depressed fracture was found in the region of the left parietal eminence. Under local infiltration anaesthesia the depressed area of bone was elevated; but the centre had to be removed because of a large spicule projecting from it, which had penetrated the membranes.

Convalescence was uneventful and he has remained free of symptoms.

Sometimes the diagnosis is in doubt, especially in adults, because depressed fractures are closely simulated by softening in the centre of a hæmatoma, especially the subpericranial variety of cephal-hæmatoma. Good stereoscopic X ray pictures may be necessary to settle the question. To elevate the bone, a wide horseshoe-shaped scalp flap should be turned down over the depression, a small hole trephined or burred out over the line of fracture, and the depressed area gently elevated and replaced. The only exception to the above practice is with "pond" fractures in children, which may elevate themselves spontaneously, if left alone for a few days.

Persistent Cerebral Contusion.

In some cases following a contusion or laceration of the brain there persists either a circumscribed oedema with localizing signs, such as hemiparesis, astereognosis, aphasia *et cetera*, or a generalized oedema, with increased intracranial pressure. In

both instances the patient may be quite conscious. Should these conditions prove resistant to repeated lumbar puncture and dehydration treatment, then operation is indicated before cortical atrophy, cerebral gliosis and fits occur. Where localizing signs exist, a decompression at or near the site of contusion will hasten the process of recovery; but usually it is wiser to carry out the classical subtemporal decompression on the affected side. The resultant defect in the bone and dura is then protected by muscle and is less likely to cause trouble to the patient in later life. In very severe cases, with extreme degrees of increased intracranial tension and defective absorptive mechanism a bilateral decompression may be necessary.

In recent years the diagnostic procedure of encephalography has been applied as a therapeutic measure in this class of case. As much cerebro-spinal fluid as possible is withdrawn from the subarachnoid space, with the patient in the upright posture, and replaced by air. The air flows into the highest parts first and, by manipulation of the head, can be made to go chiefly to the affected regions. There arachnoidal adhesions are broken down and cystic collections of fluid released. The pathways for the circulation of the cerebro-spinal fluid are thus reopened and absorption is restored, with relief of headache. Several of these cases have been successfully treated in this way in the last few years.

Intracranial Haemorrhage.

Consideration of cases of intracranial haemorrhage has been left till last, because they are the most difficult; decisions can be arrived at only after careful and repeated clinical examination and observation, as laid down previously. Considerable experience and sound judgement are often required; but the real indication for operation is the fact that the patient's condition is becoming progressively worse, instead of remaining stationary or showing a slight improvement. Nature's method of combating the rising intracranial tension due to haemorrhage or oedema, or both, is by withdrawing fluid from the ventricles and subarachnoid spaces; when this process of compensation fails, then the state of compression ensues, and, if life is to be saved, operation becomes an urgent necessity.

But operative interference must be reduced to a minimum, and can usually be limited to subtemporal decompression. The side to be explored can be determined by the signs of contralateral hemiplegia. Particularly valuable as a localizing sign is a fixed and widely dilated pupil. Exploration should always be made on this side, despite other contradictory evidence. However, if any doubt exists, especially if bilateral signs are present, there should never be any hesitation to explore both subtemporal regions; but the *dura mater* should not be opened unless necessary. If extradural clot from a ruptured middle meningeal artery is encountered, it should be removed by suction and the artery stopped with a silver clip, silk ligature or plug of bone wax. If, however, there is no gross extradural clot and

the intracranial pressure (as determined at lumbar puncture) is high and the cerebro-spinal fluid is clear, then the dura should be opened, to determine whether subdural haemorrhage exists or not. If blood clot is found, it can usually be sucked out; or it may be necessary to make another hole in the skull further back in the parietal region and wash the clot out by syringing from one hole to the other. A large osteoplastic flap is rarely necessary, unless the subdural haematoma is a very old one. Similarly, if the cerebro-spinal fluid was blood-stained and if there were signs of compression, it would be advisable to open the dura, whether extradural clot were found or not. A large quantity of blood-stained fluid is often thus released with beneficial effect.

Patients with intracranial haemorrhage requiring operation usually have a lucid interval. If none has occurred and the primary stupor is rapidly progressive, then, as mentioned before, the case is hopeless from the start. The duration of this lucid interval is frequently indicative of the type of haemorrhage causing the compression.

1. In epidural haemorrhage from a middle meningeal artery the lucid interval lasts several hours, usually from six to twenty-four or more.

2. In subdural haemorrhage, which generally comes from the cerebral veins as they enter the sagittal sinus, and is bilateral, the lucid interval is usually of some days' or even weeks' duration, although a small group of cases has been recognized recently in which the lucid interval was short, hours only. The blood makes its way slowly down over both hemispheres and the signs are usually bilateral. Variability in the state of consciousness, with secondary lucid intervals, is characteristic of this type of haemorrhage.

3. In intracerebral haemorrhage consciousness may be rapidly regained or never lost at all. The lucid interval may persist for days until the sudden onset of a fit or a succession of fits indicates that some mischief has occurred. It used to be considered that little could be done in these cases by immediate operation; but, if the site of the haemorrhage can be localized, it is now considered better to operate early and remove the blood clot by suction via a brain needle or catheter than to await the formation of an area of gliosis or cyst formation, which is more difficult to deal with, and by which time the fits may have become too firmly established to be cured. The occurrence of intracerebral haemorrhage after a head injury, often a minor one, has been too little recognized in the past, as the following case histories show.

CASE XIII.—A male, aged thirty-four years, hit his head on the windscreen of a motor lorry, but did not lose consciousness. Three weeks later he took a fit, during which he lost the power of speech and had twitchings in the right side of his face and right hand, but remained conscious. He also experienced a choking sensation and an aching pain in the left frontal region. Encephalography showed the comparative absence of air over the left frontal lobe and brought about some improvement. Fifteen months later major Jacksonian fits recurred with increasing frequency and severity. Craniotomy was performed and

adhesive arachnoiditis was found overlying an area of gliosis, probably post-haemorrhagic, deep in the middle frontal gyrus of the left frontal lobe, verified by biopsy.

After the operation there was a transient aphasia for some days. Convalescence was slow. The fits and parasthesias have persisted.

CASE XIV.—A male, aged thirty-one years, received a blow on the back of his head from the bonnet of his motor lorry. He did not lose consciousness, but was dazed and had a frontal headache. Next day he had a fit, which began in the left arm and spread to the left leg. It was of short duration. These fits recurred without any warning, at decreasing intervals. His headaches became constant; his vision became dim, due to bilateral secondary optic atrophy, and his mental condition deteriorated. His cerebro-spinal fluid pressure, in the horizontal position, was over 80 millimetres of mercury—one of the highest ever recorded. A bone flap was turned down in the right frontal region and a multiloculated cystic condition of the right frontal lobe was found. Cysts were opened and yellow fluid evacuated, allowing the area to collapse. Convalescence was uneventful. Headache disappeared and his mental condition improved tremendously. The pressure of his cerebro-spinal fluid has been taken on two recent occasions and is now normal; but his vision has only recovered slightly and his fits have recurred, but only at very infrequent intervals.

CASE XV.—A female, aged twenty-one years, was hit on the head with a gramophone, which fell off a table. No loss of consciousness occurred. Three months later she began to get transient attacks of amnesia, which occurred frequently, followed by major epileptiform fits at intervals of a fortnight. Encephalography revealed an area of localized cortical shrinkage over the right frontal lobe. At operation the membranes were found to be normal; but an area of cerebral scarring was found, the size of a walnut, in the right superior frontal gyrus. This was excised, with relief of the fits and the attacks of amnesia.

4. In subarachnoid haemorrhage, if not rapidly fatal, the primary stupor is followed by delirium, so that no real lucid interval occurs at all. As mentioned before, when discussing the indications for lumbar puncture, the evacuation of the blood-stained fluid by this route or by *cisterna magna* puncture, until the intracranial tension is normal, gives great relief. Subtemporal decompression is rarely necessary.

From the above discussion it will be realized that the real indication for operation is a progressive increase in the depth of stupor, together with a rising intracranial tension, as measured by a manometer. In the absence of these findings, signs of localized paralyses and loss of function may be due to persistent contusion and do not call for surgical intervention, despite extensive fracture. The following case illustrates these points.

CASE XVI.—A left-handed male, aged twenty-eight years, was thrown from his horse and received an extensive fracture of his skull in the right parieto-temporal region. He was unconscious for four weeks. On regaining consciousness he had aphasia for one week and subsequently some dysarthria, being able to speak only very slowly and deliberately. There remained also some paresis of the finer movements of his left hand. The intracranial tension was not raised; but some improvement occurred after 100 cubic centimetres of 50% glucose solution had been given intravenously. Later his condition relapsed; he suffered from headaches, slowness of speech, and an inability to concentrate on anything. Encephalography showed no enlargement of the ventricular system; but there was some slight displacement of both lateral ventricles to the left and an absence of air over the right cerebral cortex. A right subtemporal craniectomy was performed and some

old organized extradural clot was found with underlying *arachnoiditis serosa*. Afterwards his speech improved and he regained control over his left hand; but his neurasthenia and psychasthenia persisted, for which some occupational therapy and psychotherapy were instituted with benefit.

SUMMARY.

1. A list of pathological states included under the term "head injury" is given.

2. The importance of the traumatic stupor produced rather than the damage to the skull is stressed.

3. Attention is drawn to the occurrence of troublesome sequelae following minor injuries, and to the fact that unconsciousness may persist for a long time without increased intracranial tension and be due to contusions, both polar and *contre-coup*. Bradycardia does not necessarily imply compression, and death may follow damage to sub-thalamic as well as medullary centres.

4. Three clinical groups, based on the condition of the patient on admission to hospital, are defined, and a series of 600 consecutive cases is analysed accordingly.

5. A definite scheme for the clinical examination of each case is laid down and a method of determining at regular intervals the state of consciousness and other necessary observations is given.

6. Emergency and hospital treatment is discussed. The early adoption of the upright posture in a special bed is advocated, and the use of bromides and the barbiturates for restlessness in preference to morphine is urged.

7. A routine is set out for the prevention and control of hyperthermia.

8. The indications for lumbar puncture, both diagnostic and therapeutic, and the administration of hypertonic solutions are stated. A plea is uttered for the routine use of a simple spinal glass manometer to determine accurately the intracranial tension before deciding on active therapeutic measures.

9. The indications for and technique of operations for scalp wounds and fractures are considered in detail. The repair of defects in the cranial vault by bone grafts from the ilium is advocated.

10. The various types of traumatic intracranial haemorrhage and their relationship to the length of the lucid interval are discussed. Failure of compensation and the onset of compression call for operation. Subtemporal decompression is usually sufficient to enable evacuation of the clot. Early evacuation of localized intracerebral haemorrhage, to prevent the onset of fits, is advocated.

11. A number of case histories are submitted to illustrate many of the above points.

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Reports of Cases.

THE USE OF BLOOD TRANSFUSION IN PNEUMONIA, WITH A REPORT OF A CASE.

By EVA A. SHIPTON and F. A. E. LAWES,
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Mrs. N.M., aged forty-seven years, was admitted to the Sydney Sanitarium and Hospital on July 24, 1935. She said she had had influenza three weeks previously but had not made a good recovery. She complained of headaches, weakness, inability to concentrate, insomnia, and nervous irritability.

Examination on admission revealed a well-preserved but very pale woman. There were no teeth in the mouth and the throat looked healthy. The lungs, heart, and abdominal organs showed no abnormality. Her urine was normal. The temperature was 36.92° C. (98.4° F.), the pulse rate 80, and the respirations were 20 per minute.

The day after admission (July 25) the patient's temperature was 37.58° C. (99.6° F.), the pulse rate 98, and the respirations were 24 per minute. The patient still complained of insomnia and weakness. There were no abnormal physical signs.

On July 26 the temperature rose to 40.22° C. (104.4° F.), the pulse rate to 140 and the respirations to 30 per minute. The patient had no cough, but complained of insomnia, extreme lassitude, and heat. She looked restless, was anxious, and very pale. An examination of the chest showed a slight impairment of the percussion note at the base of the left lung, with diminished breath sounds. A diagnosis of lobar pneumonia of the lower lobe of the left lung was made, although the clinical signs were not yet distinct.

The next day (July 27) the patient had very severe vomiting and diarrhoea, and could not retain even water. An intravenous injection of saline solution and 10% glucose solution (500 cubic centimetres) was given and both of these symptoms subsided. The temperature, pulse rate, and respiration rate still remained high and the chest sounds were the same.

On the following day (July 28) the patient looked very ill; pallor, great restlessness, and anxiety were present, and at the base of the left lung fine moist râles, at the end of inspiration, together with dulness and weak breath sounds, were heard. There was still no cough. Sputum was not available at any time during the illness.

The patient did not appear to be reacting well to treatment and a full blood count was done, with the following result: Red blood corpuscles numbered 2,860,000 per cubic millimetre; the hæmoglobin value was 44% and the colour index 0.78. There was some anisocytosis with small forms, but no macrocytes. A few poikilocytes were present and also an occasional polychromatic cell. No nucleated red cells were seen. The platelets appeared scanty on the films and some large forms were present. White corpuscles numbered 10,400 per cubic millimetre; of these, 83% were neutrophile cells, 15% lymphocytes, 2% monocytes, and there were no eosinophile cells. Of the 83% neutrophile cells, 21% were band forms and 62% mature. The toxic changes in the neutrophile cells were very pronounced and the degenerative index was 84. A blood culture taken at the same time as the blood count remained sterile.

Four cubic centimetres of "Edwenil" were given, followed by two cubic centimetres, morning and night, until the crisis occurred. "Protomin" tablets were also given, one tablet morning and night, and "Diginutin", 0.6 cubic centimetre (10 minims) four-hourly. Heroin was given for sleep.

On July 29 the patient still looked gravely ill and showed no signs of response. Signs of consolidation (dulness, bronchophony) and moist râles were well heard at the

base of the left lung, and great abdominal distension was noted. The temperature was 40.55° C. (105° F.) and the pulse rate 130 per minute. The patient had symptoms of air hunger and mental confusion. An intramuscular injection of five cubic centimetres of liver extract ("Campolon") was given in the hope of stimulating a leucocytic response.²³

On the next day (July 30) the patient's condition seemed worse and no improvement was noted, either in her general condition or in the total leucocytes, which had fallen to 7,800 per cubic millimetre. The temperature was 40° C. (104° F.) and the pulse rate 130 per minute.

On the next day (July 31) it was decided to give a blood transfusion, as the patient was desperately ill and showed the following leucocyte count:

Leucocytes, per cubic millimetre	11,600
Neutrophile cells	90%
Lymphocytes	7%
Monocytes	3%

Of the neutrophile cells, 25% were band forms and 65% mature. The degenerative index was 90.

The patient's blood was found to belong to Group A. There was no trace of autoagglutination. A suitable young, healthy male donor of the same group was found and 600 cubic centimetres of blood were taken in the post-digestive period, citrated, and given to the patient very slowly to avoid too rapid filling of the venous side of the impaired circulation, with overloading of the right side of the heart.²⁴ The patient's blood pressure, taken before the transfusion, was 100 millimetres of mercury systolic and 50 millimetres of mercury diastolic. The figures were the same after the transfusion.

The patient passed a more comfortable night after this, and the next morning (August 1) looked better. She no longer had an anxious expression and was resting comfortably in bed. Her temperature was still 40.22° C. (104.4° F.), her pulse rate varied between 90 and 120 and the respirations between 30 and 40 per minute. Her systolic blood pressure was 100 and diastolic 60 millimetres of mercury. The abdominal distension was less severe.

On the following day the patient's condition had improved and she was comfortable. The temperature was 38.9° C. (102° F.), the pulse rate 100 per minute, and the respirations were 40 per minute.

On the following day (August 3), the tenth day of her illness, the patient had a crisis. The temperature became normal, the pulse rate was 90 per minute, and the respirations were 30 per minute.

The blood picture was as follows:

Red cells, per cubic millimetre	2,960,000
Hæmoglobin value	45%
Colour index	0.77
Leucocytes, per cubic millimetre	5,400
Neutrophile cells	82.5%
Lymphocytes	15.0%
Monocytes	2.0%
Eosinophile cells	1.0%

Of the neutrophile cells, 20% were band forms and 62.5% mature. The degenerative index was 86.

There was still some anisocytosis with small forms and also many polychromatic cells.

After this the patient's condition improved each day. There were a few post-critical rises of temperature, but there were no complications. The chest signs gradually disappeared, the abdominal distension vanished, and her blood pressure was restored to normal. Her colour improved and her blood count on August 14, 1935, was as follows:

Red cells, per cubic millimetre	3,420,000
Hæmoglobin value	58%
Colour index	0.85

Leucocytes, per cubic millimetre	5,800
Neutrophile cells	66%
Lymphocytes	28%
Monocytes	4%
Eosinophile cells	2%

There was no shift of the neutrophile cells and only an occasional cell showed toxic changes in the cytoplasm.

There were still some small cells and polychromatic forms. The platelets appeared normal.

The patient made an uninterrupted recovery and was discharged from hospital on September 6, 1935.

Comment.

The literature is scanty concerning blood transfusion in pneumonia. Rose and Lund¹⁰ give figures which show that blood transfusion is of some value. Flinn¹¹ reports a case of a female child, aged sixteen months, with pneumonia and severe toxæmia, who made an immediate and remarkable recovery following transfusion. Cross¹² believed intravenous transfusions to be contraindicated in cases of bronchitis, lobar and bronchopneumonia, and used the intraperitoneal route for these cases. Bass¹³ reports ten cases of pneumonic infections in anæmic infants treated by blood transfusion, and regarded it as a valuable and potent therapeutic agent.

Carlton¹⁴ observed little benefit from blood transfusion in pneumonia, but does not mention any bad effects. Cardiac embarrassment was avoided by giving the transfusion very slowly; not more than 10 cubic centimetres of blood per pound of body weight were given.

Knott¹⁵ states that there is still some difference of opinion as to how greatly transfusion can influence resistance to acute infections and, though he does not mention pneumonia, considers that if a patient shows a well marked anæmia and a deficient state of the white cells, his power of resistance will be increased if the blood picture can be rapidly improved. It is more than probable that in the case here reported a degree of iron deficiency anæmia was present before the infection commenced, as the social position of the patient was not good. Her husband had died twelve months previous to her illness, and she was in poor circumstances.

In the usual case of pneumonia anæmia is seldom a definite symptom. Naegeli¹⁶ states that the red cell count is often somewhat lowered and the reduction in hæmoglobin value is still greater. Pepper and Farley¹⁷ note that often in lobar pneumonia only a trifling reduction in red cells and hæmoglobin value is found. Occasionally, however, a more rapid reduction appears, probably from hæmolytic infection in the presence of an unusually severe blood stream infection.

Working with dogs, during a prolonged investigation of experimental pneumonia induced by the tracheal insufflation of *Bacillus bronchisepticus* and *Bacillus mucosus*, Leake and Brown¹⁸ produced satisfactory evidence to show that in this condition there is an actual loss of circulating erythrocytes without compensatory regeneration. The examination of the animals *post mortem* showed red cells in various stages of degeneration in the capillaries and tissue spaces of the lungs, liver, spleen, and intestinal walls.

In the case here reported the results of clinical and laboratory examinations, especially the high degenerative index,¹⁹ made a fatal termination to the illness extremely probable and support our opinion that without the blood transfusion the patient would have died. We also think that, provided clinical and laboratory controls are adequate and the transfusion is done by skilled hands, with all precautions, blood transfusion can be a scientific and life-saving procedure in pneumonia.

The question of chloride metabolism in pneumonia is complex and, as no chemical examinations were made in this case, the subject cannot be discussed here.

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Reviews.

A STORY OF PUBLIC HEALTH WORK.

THE name of Sir Arthur Newsholme ranks high among the world's great authorities on public health and preventive medicine. His book, "Fifty Years in Public Health", is not an autobiography—with the exception of some personal and family details in the opening chapters, he has intentionally recorded only those recollections bearing on public health—but it is an intimate personal sketch of the growth of that science and of some of its leaders during the last fifty years.¹ When the author was a medical student the germ theory of disease was gaining recognition, and in the first part of his book he deals with the development of public health up to his student days, that is, preceding the bacteriological period. This part necessarily does not consist of personal recollections; he gives an account of those pioneers and leaders whose work was most fruitful in making public health an essential part of practical politics as well as of personal hygiene—men like John Simon, Edwin Chadwick, Southwood Smith, John Snow, William Budd, William Farr, Benjamin Ward Richardson and Pettenkofer.

In the second part the author traces the progress of public health during the twenty-eight years when he was engaged in private medical practice or in public health work in a large town. The housing of the people, the control of infectious disease, vital statistics, the care of infancy and childhood, and the school medical service are some of the problems discussed. On each the author makes some pertinent comments. He has an obstinate disbelief in the decadence of the race as far as physical health is concerned, and he is firm in his protests when some modern prophets predict that through saving the lives of delicate infants, consumptive and weakly individuals by modern medical care, the standard of health and sanity of the community must be lowered. He pins his faith in the future of the race to an ineradicable belief that "what is socially desirable or in accord with Christian principles cannot be injurious to the welfare of oncoming generations", and he gives reasons for thinking that "there is no substantial evidence of widespread physical decadence or support for the view that the maintenance and extension of sanitary and sanatory work is incompatible with man's well-being".

The general population presents unmistakable evidence of an enhanced standard of health.

¹ "Fifty Years in Public Health: A Personal Narrative, with Comments", by Sir Arthur Newsholme, K.C.B., M.D., F.R.C.P.; 1935. London: George Allen and Unwin, Limited. Demy 8vo., pp. 415, with illustrations. Price: 15s. net.

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NEUROLOGICAL SURGERY AND ANÆSTHESIA.

A FEW years ago there were those who wondered whether surgery had not reached its highest peak and whether surgeons would not have to be content with the many conquests that had fallen to their lot. Since that time advances have been made and procedures thought to be impossible have been successfully accomplished. The lobe of a lung may now be removed in certain circumstances and the patient may recover; the brain may be exposed and tumours may be removed from it with a degree of success never before attained. These feats, however, can be performed only by those temperamentally fitted to undertake them, if they have been specially trained and if they have all the necessary facilities at their disposal. In this way highly specialized branches of surgery have arisen. The new, the hopeful, outlook in regard to the surgical removal of brain tumours is largely due to the work of Cushing, of America. Others have followed his lead and in many centres clinics have been established and groups of workers are devoting

themselves to this special branch of surgery. It is important that medical practitioners and hospital authorities should realize what advances have been made in the field of neuro-surgery and what may be accomplished if the work is undertaken in the right way.

The first factor in the attainment of success in cranial surgery is the accuracy with which tumours can be localized. The methods of localization have been described repeatedly in this and other journals available to Australian practitioners. Descriptions of these methods should be studied by all medical practitioners; they will not themselves apply the methods, but they will know that when the presence of a brain tumour is suspected, a definite diagnosis can as a rule be made. The second factor is the training of a team of experts to undertake the investigation of patients and the operative removal of tumours. Experience in America, in London, and elsewhere has proved conclusively that the best results can be obtained only by groups of surgeons and others working together with proper facilities and adequate equipment. A start has been made in several places in Australia to organize teams of neuro-surgeons and no doubt eventually a high standard of efficiency will be attained. Hospital authorities are concerned, for they have to provide mechanical aids and operating theatres with special fittings; they also have to provide efficient, skilled, and permanent nursing attendance. Professor H. R. Dew has stated in a recent contribution to *The Australian and New Zealand Journal of Surgery* that the provision of purely mechanical facilities comprises at least half the problem. In regard to operative technique every effort must be made to avoid shock; tissues have to be handled with the utmost gentleness, asepsis must be faultless, and hæmostasis perfect. The surgeon who undertakes the removal of brain tumours has to learn a technique quite unlike that adopted by the general surgeon and he must become skilled in the use of special instruments. The time taken for the removal of a brain tumour often runs into many hours; this is unavoidable. When the operation was performed rapidly, it was the exception rather than the rule for the patient to recover. Surgeons who

adopted the old, the rapid, technique were extraordinarily silent over the many deaths that followed operation—vague and general statements were as a rule all that could be obtained—but the successful case always achieved notoriety. It can be dogmatically stated that the present so-called slow technique has achieved infinitely better results than were obtained by the older methods. To refuse to follow modern methods with a slavish attention to minute detail is to jeopardize the life of the patient. It has been computed that at present the death rate for complete removal of cerebral tumours in Australia, even with the use of modern methods, is somewhere in the region of 80%. Cushing has for certain types of tumour brought his mortality down to as low as 7%. What the death rate with the old rapid methods was may be left to the imagination.

This brings us to the question of anaesthesia, raised so pertinently in this issue by Dr. Z. Mennell in his E. H. Embley Memorial Lecture. In the removal of cerebral tumours the most usual practice is to use local anaesthesia and basal narcosis, reinforced when necessary with gas and oxygen. On account of the length of the operation and its effect in these circumstances on the tissues of the central nervous system, the use of ether should be avoided if possible. Dr. Mennell is at a loss to understand why cerebral operations take so long and he would have the business speeded up. In a paper read before the Australian Society of Anaesthetists last September he has made the same point. The results of the modern type of cerebral operation speak for themselves. If in the future surgeons are able to evolve newer methods of securing the necessary gentle handling of tissues, asepsis, haemostasis and so forth, together with speed, Dr. Mennell's wish will be gratified. This does not at present seem possible. Dr. Mennell comes from London as an anaesthetist of world-wide reputation. His views on anaesthetics and their administration will be listened to with respect. His utterances on cerebral surgery are to be deplored in a country where neuro-surgeons are trying to bring their art to the high level attained in other parts of the world. It is to be hoped that no serious attention will be paid to them.

Current Comment.

THE EPIDEMIOLOGY OF PULMONARY TUBERCULOSIS.

PHYSICIANS interested in pulmonary tuberculosis, pathologists, those concerned with preventive medicine, and, not least in importance, the general practitioner, upon whom the early diagnosis devolves, all rely to some extent upon the information obtained by examination of the sputum. There is perhaps no single simple laboratory test which is so conclusive and so far-reaching in its effects on a patient's life as this, and yet its limitations are keenly realized by all. It is evident that even a sufferer from active open tuberculosis might not always produce bacilli in every specimen of sputum, but the impression given to the clinician is that the number of "positive" reports is less than might be expected. Culture of the sputum has been used extensively of recent years, and the older method of guinea-pig inoculation has not been supplanted for many of the investigations in which an effort is being made to detect tubercle bacilli. Evelyn M. Holmes, in a communication to the Royal Society of Medicine, draws attention to the present position as regards the bacteriological diagnosis of tuberculosis and points out that a study of this problem really furnishes another approach to the problem of epidemiology.¹ She emphasizes the transcendent importance of the open active lesion and goes on to stress the need for sustained efforts to obtain closure of such lesions. It is sputum that conveys the infection, it is the breaking down lung that provides the sputum, and it is the cavity in the lung which is a menace as a perpetual factory and storehouse of this infective material. If treatment can forestall cavity formation, this is ideal; but even if cavities exist the day is not yet lost, for they may be made to collapse by pneumothorax, with or without the severing of restricting adhesions, or some more radical method, such as thoracoplasty, may be used. It must, of course, be realized that cavities may close under a much less radical régime, but the disappointments are greater than the successes. This brings us back to the bacteriological examination again, for at any stage of the disease or of its treatment examination of the sputum is often indispensable. How, then, can its results be made more satisfying? Evelyn Holmes is perhaps a little over-enthusiastic over the results of sputum culture, but that is an advantage; more enthusiasm over the standards of routine laboratory work, much of which is often left to technicians, would not be amiss. But her results are very convincing. It is interesting to learn that the material which yielded 260 "positive" cultures failed to reveal tubercle bacilli in most instances by ordinary microscopic methods. The work that has been done on the

¹ The Proceedings of the Royal Society of Medicine, October, 1935.

mutations in form of this organism should here be remembered. It seems to be true that no slide method will ever detect bacilli as frequently as a sound cultural technique.

Further attention is drawn to certain points of prognostic importance in examining the sputum. As the author remarks, the report often merely states whether tubercle bacilli were found or not; this leaves unmentioned several important points, for the nature of the sputum, the predominant type of body cell present, the presence or absence of tissue fibres, and the appearance and distribution of the bacilli should always be stated. Busy hospital routine no doubt may beget bad habits, but "sputum negative for tubercle" is an even less satisfactory report than that terse epigram of the radiologist, "chest appears clear".

Holmes points out also the significance of the long and short bacilli, and of clumping, regarding this and the predominance of short-beaded forms as prognostically good. Here it may be remarked that if the clinical pathologist were regarded as a consultant, and if he were encouraged to check up his observations with the clinical progress of patients, it would be better all round. Finally, it must be remembered that every tuberculous patient whose lesion becomes closed ceases to become an actual risk, almost an epidemic centre, or certainly the centre of a spreading circle of infection; and therefore the duty of the profession to the public in this regard is not merely to keep the patient comfortably alive, but to keep his relatives comfortably safe. That this cannot always be done is obvious, but the ideal should still be before us. To this end the value of regular comprehensive reports on the sputum is evident, and, though it opens again the evergreen question of the growing cost of such services, it is a need that should be supplied.

TRANSPLANTATION OF TISSUES.

From time to time work has been done on the conditions governing the survival of tissue transplants. Long ago it was known that tissue transplanted from one animal to another did not always survive, although the local conditions and technique might seem quite satisfactory, and even though the animals were of the same species. Later, when the facts concerning the compatibility of red blood corpuscles were discovered, it was surmised that the position in regard to other tissue cells might be similar. Of course the reactions occurring in the foreign cells as the result of transfer to the body of a host cannot be estimated so simply as in the case of blood cells, where agglutination or hæmolysis may occur, both easy to recognize and even to calibrate. But it is possible to examine the type of connective tissue reaction that occurs in the cells of an experimental host after transplant has been carried out, and also to estimate its degree. Leo Loeb and Walter J. Siebert have recently made a

study of these reactions in birds, with the purpose of extending the observations that have been made by a number of workers on the subject.¹

The use of birds as experimental subjects involves some technical difficulties on account of the presence of feathers, since the skin is the simplest of tissues to employ as a transplant. Thyroid tissue is difficult to obtain in birds, and was not used; the authors used skin and portions of cartilage. In estimating the degree of reaction in the host's tissues, another difficulty arises in the predominant part played by the lymphocyte in the circulation of birds. A lymphocytic reaction is an important index of the relative degree of discordance between the cells of the host and those of the transplant, so that allowances must be made for the characteristic cellular composition of avian blood. From their experiments the authors draw the following conclusions. The same holds true with birds as with other vertebrates: whether the tissues of the host will attack the transplant and affect it injuriously depends upon whether the transplant is derived from a racially related animal. Autotransplants do not excite hostile reactions, provided that a correct operative technique is followed. Experiments were carried out on chickens, the bird's own tissues being used, those of a sibling derived from closely inbred strains or those of a diverse strain. It was found that even syngenic transplants, that is, those derived from closely related familial strains, excited a definite reaction, but this was less intense as a general rule than that observed where the subject animals were unrelated. Incidentally, the intense nature of the lymphocytic infiltration observed in the tissues of birds under these experimental conditions sheds an interesting light on the capacity of these cells to invade and destroy even resistant tissues like cartilage and dense fibrous tissue. Such cellular activities are well known, of course, and though other types of cell may be concerned in such scavenging manœuvres, it is interesting to realize the capacity of those round cells, the infiltrations of which are so constantly described by histologists, and the significance of which may be incompletely realized.

It may be pointed out that other workers have arrived at different results in this kind of work and have succeeded in transplanting tissues from birds of related but not identical species. In this case the hosts were newly-hatched chicks, and it is suggested that their very young tissues may have accomplished adaptation more easily. This work is not merely of academic interest. Tissue transplants are not infrequently used, and opinions are not always concordant on the subject of their fate in the body of the host. Even in so simple an operation as skin grafting the question is important; and if further attempts are made to follow the lead of Voronoff and others in transplanting glands in the treatment of endocrine disorders, a fuller understanding of the subject will be necessary.

¹ *Archives of Pathology*, July, 1935.

Abstracts from Current Medical Literature.

BACTERIOLOGY AND IMMUNOLOGY.

Vital Staining of Malarial Parasites.

V. P. SYDENSTRICKER AND G. P. VRYONS (*The Journal of Laboratory and Clinical Medicine*, July, 1935) recommend the use of vital staining in the examination of blood films for the presence of malarial parasites. Any method giving good reticulocyte staining is satisfactory, but the one used by the authors is as follows. Glass prepared for vital staining is used and a small drop of saturated solution of brilliant cresyl blue in sterile physiological saline solution is placed on a slide. A slightly smaller drop of blood is taken on a cover slip and dropped directly on to the stain. The preparation is ringed. Staining is almost instantaneous and the parasites remain alive for almost two hours on the warm stage. The cytoplasm stains irregularly and appears pale blue, with slightly darker areas; the chromatin is dark blue and the pigment readily seen. Marked differences are seen between the parasites of the different types of infection: the merozoites of *Plasmodium vivax* appear as pale blue pyriform objects with a single dark blue granule in the smaller end, while all stages of *Plasmodium falciparum* stain less intensely. After the application of quinine therapy in both species, ring forms were found only in the non-reticulated reticulocytes.

The Bactericidal Power of the Blood During Haemolytic Streptococcal Infections of the Puerperium.

RONALD HARE (*The Journal of Pathology and Bacteriology*, July, 1935) studied puerperal haemolytic streptococcal infections, in the first place with a view to deciding whether the clinical condition of the patient is or is not intimately connected with the ability of the blood to kill the homologous strain of haemolytic streptococcus and, secondly, by analysing the changes which occur in the patient's blood during an infection with haemolytic streptococci. The homologous organism was isolated from cervix, peritoneum or blood. The organism was grown on plates of horse blood agar and incubated anaerobically for sixteen hours. To preserve the culture, a portion of the agar thickly studded with colonies was cut out and placed in a tube of broth. This tube was kept frozen solid in ice and salt in a vacuum flask in the ice-chest. When subcultures were required, the frozen broth was melted and a few colonies were transferred to five cubic centimetres of 5% horse serum broth and incubated for sixteen hours. The patients whose blood was studied were all suffering from an infection of the

uterus following labour or abortion. They were divided into two groups: (A) those suffering from infections localized to the placental site, wall of the uterus and immediate neighbourhood, and (B) those infections of the uterus with extension to peritoneum or blood stream. In Group A were eight cases, and in Group B fifteen cases. The following conclusions were drawn at the end of the investigation. In patients with infections localized to the uterus or its immediate neighbourhood the bactericidal power of the blood is usually at the normal level, but tends to increase after some time. This increase may not occur or may occur only so late that it is doubtful whether the absence of invasion is due to a high degree of general immunity. In patients with generalized infections who recover, the bactericidal power of the blood is much greater than normal. In patients with generalized infections who die, the bactericidal power of the blood is greater than normal in about half the cases. The increase in the bactericidal power is due partly to the development of a bacteriostatic or bactericidal power in the serum and partly to the formation of bacteriotropins, which bring about an increase in the amount of phagocytosis.

The Pathogenicity of *Brucella Abortus* for White Mice.

WILLIAM H. FELDMAN AND CARL OLSON, JUNIOR (*Journal of Infectious Diseases*, September-October, 1935) have reinvestigated the problem of the pathogenicity of *Brucella abortus* for white mice. A sufficient number of white mice to test the pathogenicity of six strains of *Brucella abortus*, three of the bovine type and three of the swine type, were used. Five days old potato agar slant cultures of the respective organisms were used to prepare suspensions of the bacterial cultures. Thirty-six male adult white mice and twelve adult guinea-pigs received intraperitoneal injections, six mice and two guinea-pigs receiving each particular strain. At necropsy blood was obtained from the heart for agglutination tests, and half the spleen was emulsified for making cultures. Tissues were preserved for further study. From eleven out of twelve mice killed thirty days after inoculation *Brucella abortus* was recovered from emulsified spleen tissue, and agglutination titres ranged from 1 in 100 to 1 in 800 in the sera tested. *Brucella abortus* was obtained from the spleen in nine of eleven mice killed forty-four days after inoculation and the agglutination titre of the sera in ten animals tested ranged from 1 in 25 to 1 in 800. In seven of the ten mice killed seventy days after inoculation *Brucella abortus* was recovered from the spleen and agglutination titres of sera ranged from 1 in 50 to 1 in 400. Of the thirty-four mice inoculated, the organism was recovered from twenty-eight, or 83% approximately. In the guinea-pigs the agglutination titre of

the sera was not examined, but five of the six bacterial strains were recovered in splenic cultures. In two cases the organism was recovered from only one of the two guinea-pigs inoculated, and it was not obtained from either of those inoculated with one of the bovine strains. The results obtained indicate that the white mouse is a suitable test animal for the demonstration of *Brucella abortus* in obscure brucella infections and may be used as a substitute for guinea-pigs when the questions of expense and animal accommodation have to be considered. It would seem desirable to inject four or more mice with the suspected material to insure the survival of a sufficient number of animals for the experiment. The morbid anatomy of the infection in mice appears to be similar in most respects to that in guinea-pigs. Gross evidence of the disease may or may not be present, but the organism is recoverable in many instances from tissues in which no discernible lesions occur.

The Pathogenicity for Rabbits of Gravis, Mitis and Intermediate Strains of *Corynebacterium Diphtheriae*.

J. F. MURRAY (*British Journal of Experimental Pathology*, August, 1935) noted, during experiments undertaken with the object of obtaining sera of high titre from rabbits, that in almost every instance the animals injected with gravis diphtheria organisms died, while those injected with mitis strains usually survived. An attempt was therefore made to determine by a quantitative method the difference in pathogenicity between the three types of *Corynebacterium diphtheriae*. Rabbits weighing 1.5 to 2.0 kilograms were used and inoculated intravenously at five-day intervals with gradually increasing doses of the different organisms. The earlier inoculations consisted of dead bacilli, the later of living forms, with the addition of 0.1 cubic centimetre of antitoxin (one hundred and sixty units). In a series of sixty-six rabbits, 51% were killed by an intravenous inoculation of living organisms, despite the fact that the animals had previously received a long series of injections of killed organisms and were given antitoxin concurrently with the live cultures. It was noted that 32% of the animals so affected had received inoculations with organisms the cultural characteristics of which conformed to those of McLeod's mitis type, while the percentage with the gravis type was 73; the percentage with the intermediate type lay between these two extremes. Of sixteen deaths due to gravis strains, fifteen (94%) occurred before the animals received the fourth injection of living organisms (four thousand million), while only 57% of the deaths due to the mitis strains occurred so early. It was noted that paralysis of the hind quarters occurred in seven animals, four inoculated with intermediate strains, two with mitis, and

one with gravis. The author refers to the findings of McLeod and Morrison, who reported that the highest incidence of paralysis in their clinical cases occurred in those infected with the intermediate type.

Immunological Studies with the Virus of Influenza.

THOMAS FRANCIS, JUNIOR, AND T. P. MAGILL (*Journal of Experimental Medicine*, October, 1935) report the results of additional studies into the immunity reactions of animals to two strains of the virus of influenza recovered from the naso-pharynx of patients in Puerto Rico and Philadelphia. The authors summarize their results as follows. Following infection with the virus of influenza, both ferrets and mice develop a state of active immunity to reinfection. The serum of these animals contains neutralizing antibodies, as evidenced by the capacity of the serum to confer passive protection in mice against infection with the Puerto Rico and Philadelphia strains. Rabbits, which are apparently insusceptible to infection with the virus of influenza, produce specific antibodies in response to repeated injections of virus-containing material. The serum of immunized rabbits affords passive protection to mice against mouse-virulent virus. Although the subcutaneous or intraperitoneal injection of the living virus does not produce infection in mice, animals so treated acquire active immunity against subsequent infection by the intranasal route. Neutralization tests with the serum of patients before and after recovery from influenza, pneumonia and the common cold indicate that neutralizing antibodies arise as a specific response to infection with the virus of influenza. The immunological identity of strains of influenza virus recovered from human sources has been established, and the possible existence of strains of related, but not identical, antigenic structure is discussed.

HYGIENE.

Rapid Agglutination with *Bacillus Typhosus*.

E. P. JOHNS AND A. R. K. MATTHEWS (*Canadian Public Health Journal*, April, 1935) make a preliminary report of a method of rapid agglutination with *Bacillus typhosus*. They state that macroscopic slide agglutination methods have been attempted by many workers. Huddleson elaborated a satisfactory test for the diagnosis of *Brucella abortus*, using undiluted serum. The standard method for the macroscopic reaction requires the use of equal parts of diluted serum and of standardized antigen and also requires twelve to twenty-four hours for the final reading. The authors describe a rapid test which is simple, sensitive and specific. Glass plates, 32.5 by 16.2

centimetres (thirteen by six and a half inches), double diamond window glass, are marked out with a diamond into 2.5 centimetre squares. These fit over a simple illumination box. The stock antigen is prepared and standardized. A forty-eight hour agar culture of a smooth Bender strain of *Bacillus typhosus* is washed off with 15 cubic centimetres of 0.85% saline and 0.5% phenol solution and filtered, and a 1 in 10,000 saturated watery solution of gentian violet is added. This antigen is very stable at ice-box temperatures and is specific. Undiluted blood serum is used in amounts ranging progressively from 0.08 to 0.000625 cubic centimetre. One drop of the antigen, after shaking, is added to each amount; the dilutions thus range from 1 in 25 to 1 in 3,200. A wooden toothpick is used to mix each square, and the plate is tilted to and fro gently for sixty seconds. Results, the authors claim, can then be immediately read, using the illuminating box. Complete agglutination is readily recognized and takes about five minutes. In definite clinical typhoid fever 84 cases gave only two "negatives", and these were in the first week; the results became positive later. Complete agglutination took place with a titre of 1 in 3,200, this test being thus actually more sensitive than the slow test.

The Fate of Orally Ingested Bacteria.

LARS F. GULBRANDSEN (*American Journal of Hygiene*, September, 1935) writes on the invasion of the body tissues by orally ingested bacteria. The two major factors in the defensive mechanism are the acid-base equilibrium of the stomach and the gastrointestinal mucosa. In the new-born foetus the tract and tissues are free from bacteria. Within fifteen minutes of oral administration of bacterial suspension to new-born guinea-pigs broth cultures from aseptically excised organs showed pleomorphic bacterial forms, though subinoculation of agar plates yielded no growth. Whether the animals were fasting or not, digesting viable bacteria were not recovered on nutrient agar media, yet broth cultures became turbid and bacterial life was present. It is suggested that invasion is constantly occurring, but that the antigenic powers and pathogenicity become negligible owing to the dissociative effect of the mucosal cells.

Vitamin D Milk.

E. W. MCHENRY (*Canadian Public Health Journal*, August, 1935) discusses the procedures devised to increase the amount of the anti-rachitic factor in milk. Irradiation of the cow has been used only experimentally. Irradiation of milk by ultraviolet rays is used in some local dairies. In the United States of America cod liver oil concentrate (Zucker process) is often added to the milk before pasteurization. In Detroit the inclusion of the anti-

rhachitic factor in the diet of the cow has been exploited. Irradiated ergosterol, irradiated yeast and "Viosterol" have all proved effective. Laboratory tests gave 160 units per quart for irradiated milk and 500 units per quart for samples of irradiated milk and of milk from vitamin D feeding. Irradiation of the cow gave widely variant results. For the prophylaxis of rickets about 100 to 135 units in milk per day are required. Vitamin D milk is slightly more expensive; the supply for three children in an average family would mean about 1s. 3d. a week. A canned irradiated milk is available at lower cost. Of all foodstuffs so far used as vehicles for extra vitamins McHenry considers milk to be the only one that can be strongly defended. He makes a strong plea for the public health control both of the dosing of foods with vitamins and particularly the advertising claims. These should be limited to proved results. An approved process should be regularly and rigidly inspected.

The Infectivity of *Treponema Pallidum* in Excised Syphilitic Tissue.

PAUL D. ROSAHN (*American Journal of Hygiene*, September, 1935), using rabbits with active syphilitic orchitis, tested the infectivity of syphilitic tissue after excision. The material, after castration, was stored in the refrigerator and at intervals a portion was ground up in saline solution and inoculated intratesticularly after varying periods. Positive findings were obtained up to seven days, but not from fourteen days onwards. During the first forty-eight hours severe reactions occurred. Mild effects were produced by the ninety-six hour material, and after seven days sub-clinical infection occurred. There was no visible evidence, yet the lymph glands produced typical lesions when subinoculated into test rabbits. The existence of this subclinical type is of importance, as no treatment would ordinarily be given. The author suggests that all moist fomites and *post mortem* material should be regarded as a potential source of danger for at least seven days.

Diphtheria Antitoxin in the Milk of a Highly Immune Mother.

JOHN Y. SUGG (*American Journal of Hygiene*, July, 1935) states that diphtheria antitoxin was present in the milk of a mother with a high titre in the blood serum. The mother, aged thirty-five, had had her natural titre of about two units raised to twenty units by injection of toxoid, and a titre of ten units per cubic centimetre was maintained throughout nursing. The author reports that once her milk secretion was fully established there was an antitoxin percentage of about 0.25 in her serum. This represented about 18 units a day intake by the baby, or in seven and a half months 4,000 units.

British Medical Association News.

SCIENTIFIC.

A MEETING OF THE VICTORIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION was held at the Alfred Hospital, Melbourne, on July 17, 1935. The meeting took the form of a series of demonstrations by members of the honorary staff of the hospital and the staff of the Baker Institute.

Myocardial Degeneration Supervening on Coronary Thrombosis.

Dr. M. D. SILBERBERG presented a male patient, aged fifty-five years, a salesman by occupation, who had been admitted to the Alfred Hospital on October 16, 1933. Three weeks earlier he had awakened in bed with sudden pain over the heart and a heavy feeling over the left side of the chest, shoulder and arm, lasting for two or three hours. It was associated with severe dyspnoea, free sweating and a suffocative sensation. After the pain had worn off, tenderness had persisted. Though he felt very languid and dyspnoeic, he had continued at work for two weeks. He had to sit up in bed each night and had experienced a crushing feeling in the chest and had sweated freely. On the day of his admission to hospital he had had another severe attack of breathlessness. *Pulsus alternans* could be made out by palpation. The pulse rate was 116 beats per minute. The systolic blood pressure was 170 and the diastolic pressure 120 millimetres of mercury. The apex beat was 10.0 centimetres (four inches) from the mid-line, in the fifth interspace. The heart sounds were soft and well marked. Gallop rhythm was present, with reduplication of the first sound. In the lung crepitations had been heard at each base. The liver was enlarged downwards about three fingers' breadth. The urine did not contain excess of albumin or sugar, and the blood did not yield the Wassermann reaction. There was nothing of importance in the family history. The right arm had been atrophied since an attack of poliomyelitis in infancy.

During his stay in hospital the patient had had a number of attacks of precordial pain and dyspnoea. Gallop rhythm and *pulsus alternans* had persisted. The systolic blood pressure had ranged from 150 to 130 millimetres of mercury; the pulse rate had varied from 88 to 116 beats, and the respiratory rate from 20 to 36 respirations per minute. The electrocardiograms had shown a depressed *RT* in Leads I and II and domed *ST* in Lead III, with a long *Q* III (twelve millimetres). Treatment had included hypodermic injections of morphine, strychnine and atropine, as required, "Diuretin" in doses of five to ten grains three times a day, and, for a time, digitalis had been given.

The patient was discharged from the ward on February 22, 1934, and had attended the out-patient department during 1934, until he was readmitted to hospital on June 22, 1935.

Pulsus alternans had persisted, and also gallop rhythm, and a mitral systolic bruit was audible. The fundi showed retinal arteriosclerotic changes, but no retinitis or hemorrhages were seen. A series of electrocardiograms were taken and progressive changes were noted. On February 7, 1934, and on July 19, 1934, they showed depressed *RT* I and *RT* II, with *Q* III present. On October 12, 1934, and on January 16, 1935, the *T*'s were upright. On March 5, 1935, *T* I was negative, and on June 24, 1935, *T* I was more upright. Latterly he felt worse, with symptoms of constriction across the chest, precordial pain, cough and insomnia. The systolic blood pressure varied between 200 and 175, and the diastolic pressure was 140 millimetres. *Pulsus alternans* and gallop rhythm were still apparent.

Dr. Silberberg commented on the serious degree of myocardial degeneration which had followed the recurrent attacks of coronary thrombosis.

Coronary Thrombosis with Good Recovery.

Another patient shown by Dr. Silberberg was a man, aged seventy years, who, on April 4, 1935, had had an attack of pain over the heart at a time when he was at rest. Though mild at first, the pain gradually increased in intensity for one hour, and less severely throughout the evening and until the following morning. The pain was not unbearable, but the patient was restless and could not sleep; neither sweating nor breathlessness was present. The electrocardiograms taken on April 16 were typical of those seen after coronary occlusion and showed in particular the high take-off following the *R* waves in Leads II and III. Auricular extrasystoles appeared in Lead I. The tracings on May 17 showed inversion of *T* II and *T* III, with high take-off of Lead II and deep *Q* in Lead III. On June 21 some improvement was seen. The inverted *T* II was not so deep as in previous tracings.

The size of the heart was normal, but slight soft aortic and mitral systolic bruits were heard, with occasional extrasystoles. The systolic blood pressure was 170 and the diastolic 80 millimetres of mercury. No abnormal findings were made on examination of the lungs and the arteries, and at the time of the meeting the symptoms of distress had quite disappeared. Dr. Silberberg remarked that presumably the thrombosis affected only a small branch of a coronary artery.

Coronary Thrombosis and Angina Pectoris Followed by Myocardial Degeneration.

Another of Dr. Silberberg's patients was a man, aged forty-six years, who was admitted to hospital on May 14, 1935, ten weeks after he had suddenly lost the sight of the left eye, with return of vision in seven days. One month later the left arm and leg had suddenly become weak, accompanied by urgent dyspnoea, even when the patient was in bed, giddiness and intermittent swelling of the legs. Eight days before admission he had coughed up clots of blood.

He had been a man of temperate habits and, apart from rheumatism in camp during wartime, had been healthy until, in April, 1931, after lifting a tin of garbage, he had had an attack of severe pain in the chest, of about one hour's duration, radiating up to the left shoulder and down the left arm. Next day he returned to work, but was distressed with pain on slight exertion. He was unable to work for five months, seven weeks of which he spent in the Royal Melbourne Hospital on account of anginal pain on the slightest effort.

On May 14, 1935, when examined, the pulse was regular and the rate 124 beats per minute. The systolic blood pressure was 105 and the diastolic 80 millimetres of mercury. Cheyne-Stokes respiration was present. The veins of the neck were engorged and the lips cyanotic. The position of the apex beat was 12.5 centimetres (five inches) from the mid-line, in the sixth intercostal space. There was one finger's breadth of right cardiac dullness. A soft systolic murmur was heard at the apex. The lungs showed some crepitations at the bases. The liver was somewhat enlarged. There was no oedema of the legs. He had a slight left-sided hemiparesis.

On March 15, 1935, electrocardiograms showed a rate of 120 beats per minute, a notched *R* II, a biphasic *T* II, and a long *Q* III. *T* III was negative.

On July 8, 1935, the rate was 70 beats per minute, *T* I was slightly negative, *T* II and *T* III were flattened, and a long *Q* III was present.

While the patient was in the hospital the blood pressure was slightly lower at times, and sometimes he was very dyspnoeic. At the time of the meeting he still showed a serious degree of cardiac embarrassment and very poor reserve powers.

Chronic Complete Heart Block Without Symptoms.

Dr. Silberberg's last patient was a male, aged thirty-five years, who had been operated on in Dublin in 1926 for appendicitis and who had been informed at that time that the heart rate was very slow. On January 6, 1929, the apex beat was 10.0 centimetres (four inches) from the mid-

line, the rate 48 beats per minute, the systolic blood pressure 148 and the diastolic pressure 60 millimetres of mercury, and he had a slight mitral systolic bruit. Electrocardiograms taken that day and on October 20, 1933, February 13, 1934, and July 15, 1935, all showed complete heart block. The patient was an electrician and had not lost any time through ill-health.

Lantern Demonstration.

Dr. Silberberg also gave a lantern demonstration of slides illustrating cases of coronary occlusion and cases of heart block.

Reeducation in Encephalitis Lethargica.

DR. PAUL DANE presented a youth who, at the age of seventeen years, in August, 1932, was considered to have had an attack of *encephalitis lethargica*, affecting the cerebellum chiefly and the mid-brain slightly. At the onset he developed a slight cold, which cleared up quickly; after four days of normal good health he awakened one morning, intending to go to work as usual; but he felt intensely giddy and he vomited. His mother noticed that he could not speak properly. All that day he continued to vomit and to complain of great giddiness and of photophobia. On admission to hospital on the same day his temperature was 37.2° C. (99° F.), the pulse rate 78 beats, and the respiratory rate 26 per minute. Vomiting, vertigo, slight headache and photophobia persisted for several days. The cerebro-spinal fluid contained forty red cells and one white cell per cubic millimetre, there was no excess of globulin, and the fluid did not yield the Wassermann reaction. The only abnormal physical signs noticed were slight diminution of the superficial abdominal reflex on the right side and slight ptosis of the left upper eyelid; there was no muscular rigidity, he was not sleepy, nor did he become unconscious at any time. The symptoms gradually diminished, but the ptosis of the left eyelid persisted; three weeks later he had skew deviation of the eyes, with weakness of lateral movements of both eyes. The skew deviation soon disappeared, but the ptosis and weakness of lateral movement persisted for a week or two longer. After nine weeks in hospital it was noted that he had gross ataxia of both arms, but no note had been made of any ataxia of the lower limbs or of speech.

Dr. Dane said that he first saw the patient about November, 1932. The patient was grossly ataxic in all four limbs, his speech was "thick", owing to ataxia, and lateral nystagmus to both sides was present. The ptosis and ocular pareses cleared up. He was quite unable to walk or to feed himself or to write or to make himself understood, owing to ataxia of all movements. The muscles were hypotonic and, though none were very active, all the tendon reflexes were present except that of the *tendo Achillis* on each side.

Dr. Dane initiated a course of reeducation along evolutionary lines. The patient was carried into a bath of strong saline solution each day and was given lessons in simple movements of all limbs; later on, movements of a swimming nature were tried and, as ability to perform these movements returned, he was given simple movements in bed; then movements of a quadruped type were instituted, and, as he became proficient in these, more difficult movements were given; finally he got into the upright position and gradually the power of walking was attained. At the time of the meeting the patient could walk and ride a bicycle; he swayed a little to the side at times, and his speech was a little thick; nystagmus was present sometimes and the tendon reflexes had not altered. It had been noted in the hospital records that there was some mental impairment, but Dr. Dane stated that apparently this was not due to any involvement of the cerebral cortex, but to the ataxia of the speech mechanism; while under treatment by Dr. Dane the patient had not shown any signs of mental impairment.

Treatment by Suggestion under Hypnosis.

Dr. Dane showed two other patients to illustrate disorders that could be treated by suggestion under hypnosis.

One patient was a girl, sixteen years of age, who, following upon the death of her mother after a long illness, developed a severe spasmodic torticollis, which had not yielded to treatment. She proved to be difficult to hypnotize, and it was not until many attempts had been made that some measure of hypnosis was obtained. Although the stage of deep hypnosis had not been attained at any time, she had steadily improved and the torticollis had been cured. Dr. Dane considered that the torticollis represented symbolic turning away from her grief; she had not felt any grief nor had she worried over the death of her mother.

The other patient shown by Dr. Dane was a married woman, aged forty years, who had been addicted to alcohol for fifteen years. At first the craving had not been great, but during the past few years she had given way to the desire to drink until the condition had become habitual. For some months she had become rather fond of sedatives to induce sleep. She proved to be a very good subject for hypnosis, and at the second treatment attained the stage of complete hypnosis. By the time of the meeting she had been completely cured of any desire for alcohol and could sleep naturally every night. The return of natural sleep was the first result obtained, and her delight at being able to sleep when she went to bed had opened the way for the second suggestion that she would never have a craving or need for alcohol again. She had remained free from any of her former troubles for several months.

Dr. Dane demonstrated the induction of the hypnotic state in each of these patients and pointed out the difference in the responses; the young girl was in a state of light hypnosis, but the married woman showed signs of complete relaxation and deep sleep. The latter exhibited the two signs generally considered to indicate the state of deep hypnosis: two or three movements of swallowing made just before going to sleep, and fine tremor of the eyelids, which persisted as long as the patient slept.

Hypersensitiveness.

DR. CHARLES SUTHERLAND showed five patients to illustrate types of sensitiveness commonly met with and to show the results of treatment.

One woman, E.M., aged fifty-one years, when first seen in July, 1929, had had hay fever and asthma for twelve years. The symptoms were always worse between September and January, and considerable hypersensitiveness to grass pollens was demonstrated by skin tests. Desensitization with pollens produced almost complete disappearance of symptoms. Pre-seasonal treatment was carried out for two years, but was omitted in 1930. During the spring of the next two years she had had a recurrence of symptoms and again sought treatment by desensitization. This had been given before each spring season since and she had remained free of attacks.

Another woman, G.N., aged forty-nine years, had had asthma for thirty years and had spent a year in a sanatorium in 1933 on account of phthisis. Since then the sputum had been "negative" for tubercle bacilli and the temperature normal, but the asthma had been troublesome, especially in the spring. Tests yielded reactions to grass pollens and a small reaction to cat hair. She had always noticed that cats, if near her, would cause asthma and hay fever. The von Pirquet test gave a large florid reaction to human tuberculin. Desensitization with grass pollens last spring gave almost complete protection from attacks.

The next patient, E.W., a woman, aged thirty-seven years, had had asthma each spring for ten years. Tests revealed no reactions to grass pollens, but a large reaction to cape-weed pollen. Desensitization with this pollen, at intervals since 1927, had almost completely protected her from attacks.

Another patient, D.H., aged twenty-seven years, had suffered from hay fever and asthma for ten years, showed large reactions to grass pollens, and had obtained almost complete relief on desensitization.

Dr. Sutherland's last patient, a woman, K.T., aged twenty-eight years, had had asthma for eight years and showed small reactions to feathers and to house dust. Tests with pollens gave no reactions. She had improved greatly after modifications of her bedroom to reduce dust and abolish feathers and after desensitization with extracts of house dust and of feathers.

Charts, prepared by Miss Sharwood, showing variations in the pollen content of the air, were demonstrated by Dr. Sutherland.

Miss Cranage, B.Sc., and Dr. Sutherland demonstrated methods of testing for hypersensitiveness to pollens, dusts *et cetera* by the scratch and the intradermal methods.

(To be continued.)

NOMINATIONS AND ELECTIONS.

The undermentioned have applied for election as members of the New South Wales Branch of the British Medical Association:

Harrison, Leo John, M.B., B.S., 1933 (Univ. Sydney), Bridge Street, Uralla.

Cowdroy, Thomas Fielding, M.B., B.S., 1933 (Univ. Sydney), c/o Dr. Allum, Cooper Street, Cootamundra.

The undermentioned have been elected members of the Victorian Branch of the British Medical Association:

Kelly, Anthony Richard Kevin, M.B., B.S., 1933 (Univ. Melbourne), Saint Vincent's Hospital, Fitzroy, N.6.

MacDougall, Russell Angus, M.B., B.S., 1933 (Univ. Melbourne), 15, Powlett Street, Heidelberg.

Horan, John, M.B., B.S., 1930 (Univ. Melbourne), Saint Vincent's Hospital, Fitzroy, N.6.

Crooke, Arthur Albert, M.B. et Ch.B., 1908 (Univ. Melbourne), Dunolly.

Correspondence.

CLINICAL OBSERVATION ON BLOOD PRESSURE.

SIR: I have read with interest the letter of Dr. Kelly with reference to my recent paper on blood pressure, and appreciate his criticism and helpful suggestions.

With regard to several of the points he raises, I should like to offer a few facts in further explanation.

1. Physiologists have amply demonstrated on a number of occasions that indirect methods of sphygmomanometry (as used in clinical practice) are sufficiently accurate for all practical purposes when compared with their direct—or intravascular—methods carried out both on animals and human beings. They state that the error cannot at most be more than 10 or 20 millimetres of mercury.

2. Physiologists have further shown "that the amount of soft tissue interposing between the cuff and the artery, whether adipose tissue or muscle, does not make enough difference in the readings to be of any clinical importance". Dr. Kelly's experiment of interposing a layer of rubber is not altogether comparable, since a mass of rubber is highly different in composition from the tissues of the arm, bathed as they are in the normal tissue fluids. Further, with regard to the error due to contraction of the biceps muscle, this was eliminated by the routine specified for taking the readings, that is, with the arm relaxed on the bed or examination couch.

3. A Dutch physician, in a very comprehensive study of the athletes at the Ninth Olympic Games at Amsterdam in 1928, showed conclusively that well trained athletes, on the whole, had slow pulse rates and low blood pressures. Even weight-lifters, who would presumably have the greatest muscular development of all, showed an average

pressure of 139 millimetres systolic and 90 millimetres diastolic. It would seem, therefore, that muscular development, *per se*, has very little effect on the blood pressure readings. I quite realized that active and sustained contraction of the arm muscles will very materially alter the readings, as can be readily demonstrated by asking the patient to vigorously contract and relax the arm with the cuff in position.

4. Dr. Kelly mentions that arteriosclerotic processes will be unevenly distributed in the cardio-vascular system. With this I heartily agree. Were this the principal explanation of the differences, it is then surprising that the pressure is almost invariably higher on the right arm than on the left.

5. Dr. Kelly stated that the fact "that there are any cases in which the left is higher than the right seems to indicate that the dynamic theory will not fit the case". But this is not a definite conclusion, and it is often quoted that "the exception proves the rule". Only one of my 516 patients showed the pressure consistently higher on the left arm than on the right. This could be explained possibly by some anatomical variation, which could surely be possible once in over five hundred cases.

No experimental mechanical system could ever claim to exactly imitate the conditions prevailing in the cardio-vascular system, with its highly specialized and sensitive nervous control in addition.

In conclusion, the point I wished most to emphasize as a result of the clinical observations of a large number of readings on a group of patients watched over a period of years, and always estimated with a standard routine, was that there was a significant difference between the readings of the two arms in the majority of these patients.

Again thanking Dr. Kelly for his letter.

Yours, etc.,

ROBERT SOUTHEY.

164, Victoria Street,
North Melbourne, N.1,
November 21, 1935.

A CONGRESS OF COMPARATIVE PATHOLOGY.

SIR: I have the honour to inform you that the Central Committee of International Comparative Pathology in Paris has decided to hold its Third International Congress in Athens, Greece, on April 15, 1936.

By a special decree the organization of the Third International Congress of Comparative Pathology, 1936, has been entrusted to a special committee under the chairmanship of Professor Bensis and the patronage of the Greek Government.

The congress, which is exclusively scientific, will sit in Athens on April 15, 16, 17 and 18 of 1936, and will discuss the following subjects:

Section de Médecine Humaine.

1. *Néphroses et amyloses.*
2. *Echinococcoses.*
3. *Leishmanioses.*
4. *Spirochétoses.*
5. *Avitaminoses: Influence sur les fonctions digestives.*

Section de Médecine Vétérinaire.

1. *Les échinococcoses chez les animaux domestiques.*
2. *Les spirochétoses animales.*
3. *Les infections anaérobies chez les animaux domestiques.*
4. *Les leishmanioses animales.*
5. *Les animales.*

Section de Pathologie Végétale.

1. *L'immunité chez les végétaux.*

The Congress will close after a final meeting at the Amphitheatre of Epidaurus, and special travelling facilities will be accorded to the active or honorary members and their families, including a twelve days' cruise around Greece.

I will be much obliged if you would deem it advisable to communicate the contents of this letter to your Association in case that the discussions of this congress may be of some interest to the honourable members of the medical profession in Australia.

Yours, etc.,

J. KOCOTAKIS,

Consul-General for Greece.

84, Elizabeth Bay Road,
Elizabeth Bay,
Sydney,
November 21, 1935.

X RAY TREATMENT OF ACNE.

SIR: With reference to Dr. Molesworth's criticism of my paper on the treatment of *acne vulgaris*, with special reference to X rays, I should like to make the following reply.

Dr. Molesworth commences by admitting that X rays are the most rapidly effective and dramatic of all remedies advocated for the treatment of *acne vulgaris*, but goes on to say that risks, which may be justifiable in a more serious disease, are not warranted in acne. With this statement I agree entirely, but would like to draw attention to the fact that I am taking no more risk of later sequelæ than Dr. Molesworth himself, as he admits to giving large sub-erythema doses in the treatment of some cases of acne.

I think Dr. Molesworth must admit that the administration of one erythema dose of X rays over a large area like the face in a young individual is very much more likely to be followed by later sequelæ than the administration of eight one-quarter erythema doses at weekly intervals, during which time an erythema is not produced. Consequently he must admit that the administration of a "near erythema" dose would be more likely to evoke later sequelæ than eight weekly one-quarter doses, in view of the definite temporary exacerbation of the acne lesions which the large dose produces to a very much greater degree than is ever produced by the administration of eight one-quarter erythema doses. Particularly would the danger of sequelæ be greater if allowance is not made for the extra 20% due to secondary radiations in an area as large as the face, bringing the actual dose very close to a true erythema.

I grant that the administration of sixteen or more one-quarter erythema doses may carry a small added amount of risk, but personally I have never employed more than eight one-quarter doses consecutively, followed in a few cases by a further four one-quarter weekly erythema doses after a rest interval varying from one to twelve months.

I stated in my paper that no more than a total dosage of four erythema doses should be employed, and also that three-quarter erythema doses could be used every three weeks. But in this I was quoting MacKee, the author of the present-day standard text-book of cutaneous X radiation, and have never given so much nor employed more than one three-quarter erythema dose myself on the same patient. I have actually seen mild telangiectases on the face of two patients treated with one three-quarter erythema dose of X rays (fortunately not treated by myself), but have not yet seen trouble of any kind following the use of eight one-quarter erythema doses delivered at weekly intervals, and I am far from being the only dermatologist in Australia employing this method of treatment.

Dr. Molesworth states that the method of treatment advocated by him in THE MEDICAL JOURNAL OF AUSTRALIA, July 3, 1926, still remains his sheet anchor in the treatment of acne. I used this method of treatment for a considerable time and eventually discarded it in favour of those mentioned in the early part of my paper, as the results were comparatively poor (as, indeed, are the majority of results with any treatment except X rays). I know of no other practising dermatologist who now

uses Dr. Molesworth's treatment in the manner described in the article to which he refers, as he practically admits in this article that his treatment does not cure the acne, but "must be continued until at twenty-two or so the acne age is past for most patients". This may take a matter of years, and of necessity must be followed in many cases by much acne scarring. He also claimed in his criticism that the majority of patients, especially girls, who will perform the treatment regularly and efficiently, can be cleared of acne without ever using X rays, and at a much smaller cost than by a long series of X ray treatments. It will be noticed that the actual percentage of his cures, the length of time that the treatment had to be continued, or the number of patients who discontinued treatment and went to someone else, have not been mentioned. This, I think, will speak for itself. Also I consider it is very much more economical for a patient to receive the course of X rays mentioned in my paper than to carry on indefinitely with local applications for from six months to two years or longer, and possibly still have to receive X ray treatment after all.

Dr. Molesworth also says that there are many grades of *acne vulgaris*, and to advocate the use of X rays in all cases shows, to his mind, too great enthusiasm or a faulty sense of proportion. I would refer him back to my paper on page seven, paragraph three, where I stated that it is my practice to commence with treatment other than radiation in mild cases, and also in those around puberty. In point of fact, I nearly always try any case for a few weeks on local treatment, on the off-chance that improvement may follow. But so rarely is this the case that I feel inclined now to commence X radiation on the more marked cases from the beginning, and not waste their time. Also he will note in the same paragraph that I do not spray X rays on all cases indiscriminately, as he appears to infer. I have stated there that in very blonde young women, and in people with dry skins, the total dose of X rays is reduced to one and a half erythema doses, four of the component doses being weekly one-eighth erythema doses. Likewise he appears to have missed what I said in paragraph two on page six, where definite lines are laid down regarding the observance of low tolerance and indications as to maximum skin tolerance, which are of great importance.

In Dr. Molesworth's fifth paragraph, he states that to continue X radiation until no post-radiation measures are necessary is quite unjustifiable. The wording of this remark is inclined to give a wrong impression, as X radiation is not kept up indefinitely by me until no post-radiation measures are required, but is given in a standard series of doses which have been scientifically evolved by others and stood the test of time. These doses are employed with modifications in number and size, according to the type of acne and complexion *et cetera* of the individual. When used in this manner, post-radiation treatment becomes unnecessary, as a complete cure results in nearly all cases.

Dr. Molesworth's next three paragraphs are devoted to the action of X rays on the sebaceous glands. I agree with all he says in those paragraphs, with the exception of his statement that the basal layer of the epidermis proper must be damaged to an extent not less than the secreting membrane of the sebaceous glands. I believe, in agreement with other dermatologists and radiologists with whom I have consulted, that the sensitivity of the epithelium of this membrane to X rays is such that it is more damaged than the basal epidermal layer, despite the fact that less actual radiation reaches it. This belief is supported by the clinical results obtained by my method of treatment.

Dr. Molesworth then quotes twelve instances of damage appearing long after the cessation of X ray treatment delivered in fractional doses similar in total and even longer in time of distribution than that advocated by me. Unfortunately I have no copy of the *Archiv für Dermatologie und Syphilis*, Volume CLXVIII, Number 3, from which he quotes. But it is a very vague criticism, as Dr. Molesworth has not said what actual dosage was employed, either in fractions or in total, what types of acne were treated, or whether the precautions advocated in my paper

were observed. It can hardly be claimed as a just criticism unless observance or otherwise of these factors is mentioned. Also nothing has been said as to how long ago these cases were treated, and what type of apparatus, dosimeters *et cetera* were employed. This criticism simply appears as a sweeping statement unsupported by necessary facts.

With regard to the possible risks of later sequelæ as a whole, nobody can deny that there is a slight element of risk in the use of X rays for practically every condition for which they are used. If Dr. Molesworth would delve a little further into the literature, or communicate with other dermatologists, he would find that the Americans are not the only ones who give most support to X ray treatment for acne, although admittedly they have written more about it. A number of dermatologists in Sydney now use similar X ray dosage to that advocated in my paper. In Melbourne also there are advocates of this or similar methods of treatment, as I know from personal communications.

Dr. Molesworth must be arguing purely from theory and from experience of other conditions besides acne, as I feel confident that if he would only give this method of treatment the fair trial that I gave his, he would use no other. For myself, I feel that pride of place must be given to the statistics and experience of men like MacKee, Andrews, Hazen *et cetera*, as is only natural, in view of the fact that they have had very much more practical experience in the treatment of acne than Dr. Molesworth, owing to the larger clinics which they control.

With reference to Dr. Molesworth's last paragraph, I in turn would like to say that if a daughter of mine suffered from acne, I cannot imagine any argument that would persuade me not to employ X rays, as advocated in my paper, if local measures fail to produce a quick response. I would infinitely prefer to take the almost negligible risk of later mild sequelæ from X rays than the practically certain risk of the unsightly scarring produced by acne itself when treated by local applications over long periods, especially as the affliction is almost invariably accompanied by an inferiority complex and unhappiness so often experienced in young girls with this disfiguring condition.

I would like to conclude by saying that I have no desire or intention of entering into a long controversy on the subject, particularly with one for whom I have so great a respect as Dr. Molesworth, and consequently will not make any further reply to anything Dr. Molesworth may subsequently write. I have only replied on this occasion as I felt in duty bound to exonerate the most efficient and reliable method of treatment for acne which we possess today, from the apparent discredit cast upon it by Dr. Molesworth's criticism. If any further criticism is levelled at this method of treatment, I will rest content in the certain knowledge that the results obtained by it will speak more eloquently for themselves, in comparison with those obtainable by Dr. Molesworth's treatment, than any amount of verbal argument.

Yours, etc.,

JOHN C. BELISARIO.

143, Macquarie Street,
Sydney,
November 27, 1935.

ABSCESS OF THE LUNG AND DENTAL OPERATIONS.

SIR: Under the heading of "Current Comment" in THE MEDICAL JOURNAL OF AUSTRALIA of November 23 reference is made to abscess of the lung and dental operations. No reference was made, however, in the comment to the type of anaesthesia most successful in helping to prevent what, as the writer of the article showed, is not a very rare complication.

Although the cause of lung abscess has been explained by two different schools according to two different theories, namely, the embolic theory and the aspiration theory, I think there is sufficient evidence in favour of the aspiration theory, for example, a tooth, to make it

obligatory on anaesthetist and dentist to prevent blood, especially when infected, and other foreign particles from entering the trachea.

For this purpose I am now using intratracheal ether under positive pressure. In this district, where most of the dental extractions under anaesthesia are performed in the patients' homes, this may be a nuisance, but it is quite practicable, and the time spent may be more than saved in the post-operation period. I have also used in a patient's home gas, oxygen and ether by a Magill's tube in the trachea without positive pressure (inhalation method), the pharynx being packed off by the dentist with gauze. Which of the two methods I shall finally adopt I have not decided, but at present I prefer the positive pressure.

The sucker is now accepted as one of the indispensable instruments in this operation, and I hope it will not be long before an intratracheal method is also the accepted type of anaesthetic. I think it a fair rule to follow, that if the extractions cannot be completed without a second dose of anaesthetic (and who can tell beforehand?) the anaesthetic should be given by an intratracheal method.

The cost of a reliable machine is no more than that of one week's holiday for a doctor. The interest on the expense can be saved in two anaesthetics if patients are taught that the added safety is worth the added cost.

Anyhow, if a method is better than the prevalent one, it must in time be adopted, so why not before avoidable disasters occur?

It was such a disaster which happened to me some years ago and a case I saw recently in consultation which prompt this letter.

Yours, etc.,

C. R. FURNER.

Bank Chambers,
17, Bolton Street,
Newcastle,
November 29, 1935.

Post-Graduate Work.

THE NEW SOUTH WALES POST-GRADUATE COMMITTEE IN MEDICINE.

Residence at Obstetric Hospitals.

It is announced that arrangements have been made with the Royal Hospital for Women, Paddington, and the Women's Hospital, Crown Street, for residence for graduates in the medical officers' quarters for from seven to fourteen days. Whilst no special instruction will be given, those in residence will have every opportunity to see the work of the institution. A list of bookings of the names of those who apply for this course will be kept, and dates will be allotted in order of precedence of receipt of applications. Where the period applied for is no longer vacant, the applicant will immediately be notified of the dates available.

Applications should be made to the Secretary, New South Wales Post-Graduate Committee in Medicine, the University of Sydney, enclosing cheque, giving the period and date desired, and stating that the applicant agrees to abide by all by-laws, rules and regulations of the hospital and of the Post-Graduate Committee. The fee for this course is £2 2s. a week. Exchange should be added to country cheques.

Medical Prizes.

THE ARCHIBALD WATSON PRIZE IN ANATOMY.

THE Medical School of the University of Adelaide celebrated its jubilee last August. Professor Archibald Watson, the first holder of the Elder Chair in Anatomy, is

the only survivor of the teaching staff which was appointed at the inception of the Medical School. It was a matter of regret that he could not be present at the celebrations. Some of his old students felt that the occasion should not be allowed to pass without establishing some lasting memorial of his services to anatomy and surgery. It was therefore decided to found an Archibald Watson Prize in Anatomy, and all those who had studied under him were informed of the project. There was a ready response; not only did most of his old students contribute, but also some graduates in the other States who wished to show their appreciation of a great surgical anatomist. In all, £244 was contributed. Of this sum, £52 10s. has been spent on a splendid portrait of Professor Watson by McInnes. This portrait has been presented to the University by the subscribers. Every subscriber has received an excellent coloured reproduction of the portrait, the total cost of the reproductions amounting to £12. When incidental expenses have been met an amount of £170 remains to found the Archibald Watson Prize in Anatomy. The conditions governing the award of the prize have not yet been drawn up. They will be published at a later date.

For the information of subscribers the following statement is published.

*Memorandum of Fund for Archibald Watson Prize
in Anatomy.*

£ s. d.	£ s. d.
Amount received from subscribers 244 2 8	Cost of portrait . 52 10 0
	Cost of 300 repro- duction of por- trait 12 2 6
	Cost of incidental expenses, print- ing, postages, freight, etc. ... 9 1 3
	73 13 9
	Balance 170 8 11
£244 2 8	£244 2 8

Analytical Department.

"GLOBEX."

"GLOBEX" is a beef extract manufactured in Australia under Commonwealth supervision by James Barnes, Limited. This firm has been established for many years and has specialized in the preparation of canned food products. The beef used in the manufacture is obtained from cattle fed on pastures in practically all parts of the Commonwealth.

The manufacturers claim that an analysis of the product yields the following results:

Moisture	30.00%
Soluble inorganic matter	10.85%
Insoluble inorganic matter	2.93%
Soluble organic matter	32.93%
Insoluble organic matter	21.29%

Included in the inorganic matter was 6.66% sodium chloride.

A sample of "Globex" was submitted to our analyst, who reports as follows:

Moisture	33.10%
Total ash	13.72%
Protein (N x 6.25)	49.40%

Sodium chloride was present to the extent of 7.3%; phosphate as P_2O_5 was 2.13%; iron as Fe was 0.0084%.

The iron content is thus relatively high. Green vegetables, which are regarded as important dietary sources of iron, rarely contain more than 0.0016% of iron. Invalids on a diet consisting largely of milk might not receive the minimum daily requirement of 0.01 gramme of iron, since thirty fluid ounces would contain only about 0.0008 gramme. Three cups of beef tea, made with ten grammes of extract to one cup of water, would contain 0.0025 gramme, or 25% of the daily iron requirement, and would provide at the same time 0.64 gramme of P_2O_5 , or 21% of the daily requirement.

"Globex" may be recommended as a reliable beef extract.

Obituary.

FRANCIS STANISLAUS LOUGHNAN.

We regret to announce the death of Dr. Francis Stanislaus Loughnan, which occurred on November 25, 1935, at Melbourne, Victoria.

JOHN FLEMING.

We regret to announce the death of Dr. John Fleming, which occurred on November 29, 1935, at Parkdale, Victoria.

JOHN JOSEPH STANLEY.

We regret to announce the death of Dr. John Joseph Stanley, which occurred on December 7, 1935, at Gympie, Queensland.

University Intelligence.

THE UNIVERSITY OF SYDNEY.

A MEETING of the Senate of the University of Sydney was held on December 2, 1935.

The degree of Bachelor of Surgery (B.S.) was conferred *in absentia* upon Warwick Hector Bailey, M.B.

On the recommendation of the Faculty of Medicine, it was resolved to admit Mr. A. A. Abbie, M.B., B.S., B.Sc., to the degree of Doctor of Medicine for his thesis and supporting paper, entitled respectively: "The Brain-Stem and Cerebellum of *Echidna Aculeata*" and "The Projection of the Forebrain on the Pons and Cerebellum".

The examiners reported that Mr. Abbie's thesis was an original contribution of distinguished merit, adding to the knowledge of medical science. (Mr. Abbie graduated in 1929 as Bachelor of Medicine and Bachelor of Surgery with second class honours. He at present occupies the position of Senior Lecturer in Anatomy in the University Medical School.)

On the recommendation of the Faculty of Dentistry it was resolved to admit Mr. R. M. Kirkpatrick, B.D.S., to the degree of Doctor of Dental Science for his thesis entitled "Some Observations on the Pathogenesis of Gingivitis".

The examiners reported that Mr. Kirkpatrick's thesis was an original contribution of distinguished merit, adding

to the knowledge and understanding of dental science. (Mr. Kirkpatrick graduated as Bachelor of Dental Surgery in 1925 with second class honours. In 1933 he was appointed to the Dental Research Scholarship awarded by the Australian Dental Association (New South Wales Branch) and the Walter and Eliza Hall Trust. He is at present Lecturer in Dentistry in the Dental School.)

Books Received.

FOR AND AGAINST DOCTORS: AN ANTHOLOGY, compiled by R. Hutchison and G. M. Wauchope; 1935. London: Edward Arnold and Company. Crown 8vo., pp. 168. Price: 7s. 6d. net.

HIGH BLOOD PRESSURE AND ITS COMMON SEQUELÆ, by H. O. Gunewardene, M.B., B.S., D.M.R.E.; 1935. London: Baillière, Tindall and Cox. Demy 8vo., pp. 183, with illustrations. Price: 7s. 6d. net.

GREAT DOCTORS OF THE NINETEENTH CENTURY, by W. Hale-White, K.B.E., M.D., LL.D. (Hon.), F.R.C.P.; 1935. London: Edward Arnold and Company. Demy 8vo., pp. 332. Price: 15s. net.

THE STOMACH AND DUODENUM, by G. B. Eusterman, M.D., F.A.C.P., and D. C. Balfour, M.B., M.D., LL.D., F.A.C.S., F.R.A.C.S.; 1935. Philadelphia: W. B. Saunders Company; Melbourne: W. Ramsay. Royal 8vo., pp. 273, with 436 illustrations. Price: 63s. net.

Diary for the Month.

DEC. 17.—Tasmanian Branch, B.M.A.: Council.
DEC. 17.—New South Wales Branch, B.M.A.: Medical Politics Committee.
DEC. 20.—Queensland Branch, B.M.A.: Council.

Medical Appointments.

Dr. F. H. Makin has been appointed Honorary Consulting Dermatologist at the Adelaide Hospital, South Australia.

Dr. A. A. Altmann has been appointed, pursuant to the provisions of the *Workers Compensation Act, 1928*, to be a Certifying Medical Practitioner and a Medical Referee at Mornington, Victoria.

Dr. J. B. Hogg has been appointed Medical Officer of Health by the Koorda Road Board, Western Australia.

Dr. A. J. Hakendorf has been appointed Honorary Anæsthetist at the Adelaide Hospital, South Australia.

Medical Appointments Vacant, etc.

For announcements of medical appointments vacant, assistants, *locum tenentes* sought, etc., see "Advertiser", pages xviii, xix, and xx.

CHILDREN'S HOSPITAL, CARLTON, VICTORIA: Honorary Officers.

HEATHERTON SANATORIUM, CHELTENHAM, VICTORIA: Resident Medical Officer.

MOTHERS' AND BABIES' HEALTH ASSOCIATION, ADELAIDE, SOUTH AUSTRALIA: Medical Officer.

PRINCE HENRY'S HOSPITAL, MELBOURNE, VICTORIA: Resident Medical Officers.

QUEEN VICTORIA MEMORIAL HOSPITAL, MELBOURNE, VICTORIA: Registrar, Resident Medical Officer.

RENWICK HOSPITAL FOR INFANTS, SYDNEY, NEW SOUTH WALES: Honorary Officers.

THE WOMEN'S HOSPITAL, CROWN STREET, SYDNEY, NEW SOUTH WALES: Honorary Clinical Assistant.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment referred to in the following table without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

BRANCHES.	APPOINTMENTS.
	Australian Natives' Association. Ashfield and District United Friendly Societies' Dispensary. Balmain United Friendly Societies' Dispensary.
NEW SOUTH WALES: Honorary Secretary, 135, Macquarie Street, Sydney.	Friendly Society Lodges at Casino. Leichhardt and Petersham United Friendly Societies' Dispensary. Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney. North Sydney Friendly Societies' Dispensary Limited. People's Prudential Assurance Company Limited. Phoenix Mutual Provident Society.
VICTORIAN: Honorary Secretary, Medical Society Hall, East Melbourne.	All Institutes or Medical Dispensaries. Australian Prudential Association, Proprietary, Limited. Mutual National Provident Club. National Provident Association. Hospital or other appointments outside Victoria.
QUEENSLAND: Honorary Secretary, B.M.A. Building, Adelaide Street, Brisbane.	Brisbane Associate Friendly Societies' Medical Institute. Chillagoe Hospital. Members accepting LODGE appointment and those desiring to accept appointments to any COUNTRY Hospital, are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.
SOUTH AUSTRALIAN: Secretary, 207, North Terrace, Adelaide.	All Lodge appointments in South Australia. All Contract Practice Appointments in South Australia.
WESTERN AUSTRALIAN: Honorary Secretary, 205, Saint George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.
NEW ZEALAND (Wellington Division): Honorary Secretary, Wellington.	Friendly Society Lodges, Wellington, New Zealand.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

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